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END OF SEARCH HISTORY

L2: Entry 14 of 25 File: USPT Sep 26, 1995

DOCUMENT-IDENTIFIER: US 5453200 A
TITLE: Precifitation process for exocellular proteins

Abstract Text (1):
In a process for separating the exocellular proteins from the micro-organisms of a filtered fermentation liquor, the removal of solid is to be improved while retaining the useful substance. This is achieved by, in a first stage, removing substances preventing protein precipitation with the aid of a solid adsorption agent; concentrating the remaining solution to a protein content of about 30 to 40% by weight; and then precipitating and separating the protein, optionally with the addition of precipitants for protein to accelerate the precipitation, at pH values between 6 and 10.

Brief Summary Text (4):
Numerous enzymes, especially hydrolases, such as for example proteases, amylases or lipases, are produced by fermentation of microorganisms. Suitable microorganisms and processes for their production are described, for example, in the following patents and patent applications: DE 18 00 508, DE 22 24 777, DE 25 51 742, U.S. Pat. No. 3,827,938, WO 88/01293, DE 18 07 185, U.S. Pat. No. 3,740,318, DE 23 34 463, DE 20 26 092, EP 0 232 169, EP 0 220 921, EP 0 247 647 and EP 0 246 678.

Brief Summary Text (5):
Strongly coloring or strong-smelling impurities are unacceptable for numerous applications, for example for the use of the enzyme solutions in liquid detergents. Accordingly, in the industrial production of the enzymes, the impurities tend to be removed by precipitation processes. However, hitherto known precipitation processes have the disadvantage that considerable losses of yield have to be accepted in order to obtain good color quality. To counteract these difficulties, German patent application P 39 11 099.0 describes a precipitation process in which a masking agent is added to an enzyme solution produced by fermentation and a precipitate is subsequently prepared by adding two water-soluble, mutually precipitating ionic compounds in any order and optionally introducing other adsorbents, for example active carbon.

Brief Summary Text (14):
It is possible by the process according to the invention to purify numerous proteins which are produced by fermentation of microorganisms and which are present as exocellular proteins in the fermenter broths. For example, it may be used in particular for the production of enzymes, for example for the production of proteases, amylases, cellulases, xylanases, pentosanases or lipases. The process according to the invention is particularly suitable for the production of proteases, particularly alkaline proteases, such as serine proteases.

Brief Summary Text (28):
Various processes are available to the expert for producing the concentrated enzyme solutions. Thus, micro filtration and/or ultrafiltration may be used and the enzyme solutions obtained may be brought to even higher concentrations either beforehand or afterwards by distilling off water under reduced pressure, for example in a thin film evaporator. In one particularly preferred process, the enzyme solutions are first prepurified by microfiltration and ultrafiltration, subsequently precipitated

and finally concentrated by evaporation. In this process, the micro filtration and ultrafiltration steps are carried out in particular as described in German patent application DE 37 30 868. This patent application describes a process for the separation of biotechnologically produced useful materials from a fermenter broth by crossflow microfiltration and/or ultrafiltration using at least two modules arranged in tandem and equipped with porous membranes for each stage, characterized in that a different excess pressure relative to the ambient pressure is applied to each module on the permeate side. To carry out this process, a crossflow rate of more than 4 m/sec is preferably used in the microfiltration stage and inorganic materials, such as aluminum oxide, silicon carbide or zirconium dioxide on a support, are preferably used as the membrane materials.

Detailed Description Text (3):
200 1 of a fermenter broth having a specific protease activity of 34850 HPE/g were prepared by fermentation of a Bacillus licheniformis strain, which produces an exocellular protease of Bacillus lentus, and further processed as follows:

Detailed Description Paragraph Table (1):

Apparatus: Type Tube modules Pilot plant 2S151, manufactured by TECHSEP, France Filter area 2 .times. 3.4 m.sup.2 (2 modules in tandem) Membrane material Type M14 zirconium oxide on graphite Cutoff limit 0.14 .mu.m Operating conditions: Working temperature 40.degree. C. pH in the retentate 8 Adjusted with 30% NaOH Retentate crossflow 4.8 m/s (= 75 m.sup.3 /h circulation) Retentate inflow 1000 l/h Mean transmembranal 0.5 bar Adjusted for each module by pressure correction of the permeate pressure

Detailed Description Paragraph Table (4):

Apparatus: Type Millipore spiral module Filter area 5.6 m.sup.2 Membrane material Polysulfone Cutoff limit 10,000 daltons Operating conditions: Working temperature 25.degree. C. Retentate inflow 2500 l/h Mean transmembranal pressure 1 bar

Detailed Description Paragraph Table (7):

Apparatus: Type .alpha.-Laval CTIB-2 Centritherm thin layer evaporator Heating area 0.09 m.sup.2 Evaporator capacity 50 kg/h (water) Operating conditions: Primary steam temperature 80.degree. C. Secondary steam temperature 35.degree. C. Secondary steam pressure 0.01 bar

Current US Cross Reference Classification (1):
210/650

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temperature, however, is not high enough to damage the components of the media.

Detailed Description Text (2):
Displacement pumps 5, 6, 7, and 8 combine various component tributaries 1, 2, 3, and 4 into a mainstream 9. Mainstream 9 is heated in a heat exchanger 10 and then flows through a transverse-flow filtration module 11. Module 11 accommodates a membrane 12. Membrane 12 separates mainstream 9 into an accordingly sterilized permeate 13 and a non-sterile retentate 14. A pump 15 forwards permeate 13 to an unillustrated bioengineering reactor. Retentate 14 is diverted to a centrifuge 16. Centrifuge 16 constantly precipitates microorganisms out of retentate 14. The clarified retentate 17 leaving centrifuge 16 is returned to mainstream 9 before it enters heat exchanger 10. The line that conveys clarified retentate 17 accommodates a pressure regulator 18. Pressure regulator 18 communicates with displacement pump 5 through a line 19.

Detailed Description Text (4):
Increasing the temperature of mainstream 9 to 70.degree. C. in heat exchanger 10 exterminates many germs and inhibits the growth of heat-resistent types to such an extent that it prevents overload of the centrifuge and filtration module. The medium, however, never becomes hot enough to threaten its components.

Detailed Description Text (5):
The membrane 12 in transverse-flow filtration module 11 now separates the accordingly treated mainstream 9 into a sterile permeate 13 and a germy retentate 14. Retentate 14 must flow rapidly enough to prevent membrane 12 from clogging up.

Current US Cross Reference Classification (1):
210/650

CLAIMS:

1. A method for continuously preparing a sterile culture medium, comprising the steps of:

providing unsterilized fluid components in separate streams;

combining the separate streams into a single mainstream;

continuously applying the mainstream to a transverse flow filtration module having a membrane which separates the mainstream into a permeate and a retentate;

continuously feeding the permeate to a bioreactor;

diverting the retentate to a centrifuge to continuously precipitate contaminants out of the retentate; and

returning clarified retentate from the centrifuge into the mainstream upstream of the transverse flow filtration module.

2. The method according to claim 1, further comprising maintaining the mainstream with the returned retentate at a temperature of at least 70.degree. C.

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L2: Entry 9 of 25 File: USPT Jan 12, 1999

See 1047

DOCUMENT-IDENTIFIER: US 5859262 A
TITLE: Process for the production of erythorbic acid

Abstract Text (1):
The invention provides a process for the recovery of erythorbic acid from an aqueous feed solution containing values of erythorbic acid at a concentration of less than 0.7 mol/kg, comprising adsorbing a major portion of said erythorbic acid with a solid phase adsorbent resin selected from resins carrying a pyridine function and resins of similar or weaker basicity; separating said erythorbic acid-containing resin from residual aqueous solution, and subjecting said erythorbic acid-containing resin to a desorbing operation with a neutral solvent at a temperature of at least 20.degree. C. higher than the temperature at which said adsorption is carried out, whereby there is obtained a solution of erythorbic acid in solvent in which the concentration of erythorbic acid is at least equal to its concentration in said aqueous feed solution.

Brief Summary Text (4):
In carrying out the process according to that invention, both a direct fermentation method and a cell suspension process may be applied.

Brief Summary Text (5):
In carrying out the direct fermentation method, too low concentration of the carbon source would result in decreased conversion to the product due to consumption of the source for the propagation of the cells. Too high concentrations would lead to lower yield due to greater conversion to byproducts and to a larger amount of residual sugar. It is preferable to use a concentration between 0.5 and 10%. It is also preferred to keep the concentration between about 0.5 and 1.0% by continuously adding the material. Other substances present in the medium are organic or inorganic assimilable nitrogen sources, mineral salts and a trace of various metals. pH is usually maintained between about 3 and 7. The time required for the fermentation is from 5 to 10 days in the case of surface culture and from 3 to 7 days in the case of submerged culture. The preferred temperature in the fermentation is 26.degree. to 28.degree. C.

Brief Summary Text (6):
Production of D-araboascorbic acid using the intact cell or dried cell preparation is effected in a buffer solution having a pH of about 4.0 to 6.0. The concentration of the carbon source is 0.5 to 10%, the temperature between 35.degree. and 30.degree. C. and the time is between 50 to 80 hours. The substrate is preferably added in intervals to keep its concentration between 0.5 and 1.0%.

Brief Summary Text (7):
The isolation of D-araboascorbic acid may be performed by first removing the mycelium by means of filtration or by means of a centrifugal procedure and subsequently applying the known procedures for isolating L-araboascorbic acid to the filtrate or supernatant. For example, an adequate amount of barium acetate is added to remove phosphates and sulfates and organic impurities are removed by treatment with active charcoal, followed by adsorption of the desired product on anion-exchange resin such as Amberlite IR4B and elution with aqueous hydrochloric acid. Furthermore, impurities are removed by means of a small amount of active

charcoal and butanol and D-araboascorbic acid is crystallized by concentration in vacuum at low temperature under carbon dioxide, followed by recrystallization from solvent such as acetone or ethanolligroin.

Brief Summary Text (8):
The product concentrations, g/l, (and fermentation pH and duration) in Examples 1 to 7 of said US patent are respectively: 0.5-1.2 (pH=5-6, 7 days), 2-3 (pH=5, 3 days), 4.2 (pH=5.6, 4 days), 5.3 (pH=5.3, 5 days), 5 (pH=5.6, 10 days), 1.4 (pH=5, 4 days), 10.3 (5.0 for the initial 20 hours and about 4.0 for the remaining 40 hours).

Brief Summary Text (9):
In Examples 1 to 6 the culture filtrate, after treatment with 1 g. of barium acetate and 0.1 g. of active charcoal, is adsorbed on ion-exchange resin IR-4B, followed by elution with 1 liter of 1N-HCl. About 70% of the total content of the desired product is eluted in fractions in volume of 200-300 ml. after initiation of the elution. These fractions are shaken with butanol and, after addition of a small amount of active charcoal, are filtered to give an almost colorless transparent liquor, which is concentrated to near dryness in vacuum at temperature below 30.degree. C. under CO.sub.2-, followed by several concentrations in the presence of ethanol to remove most of the water. The oily substance thus obtained is allowed to stand in a vacuum desiccator for 2-3 days to separate crystalline D-araboascorbic acid.

Brief Summary Text (12):
Seven years after said US patent was granted, the inventor issued an article entitled: Erythorbic acid fermentation, which was published in Biotechnology and Bioengineering Vol. XI, pages 1157-1171 (1969). (Takahashi had several earlier publications, see references in the 1969 article.) Two other related publications, by Yagi and co-workers and by Shimizu and co-workers, respectively are: Studies on Erythorbic acid production by fermentation, Part I, Erythorbic acid producing strain and cultural conditions and Part II, Erythorbic acid production by jar fermentors, published in Agr. Biol. Chem. Vol. 31, pages 340-345 and 346-352, respectively (1967). These articles describe studies directed to development of an industrial process including strain improvement, optimization of culture solution (carbon source, nitrogen source, additives, effects of iron and copper and of chelating agents), temperature, aeration and agitation.

Brief Summary Text (13):
Glucose and sucrose were found to be the most appropriate carbon source. Glucose concentration should be in the range of 8-12%. In one test the fermentation was started with 8% glucose, 8% glucose was fed on the third day and 4% glucose was fed on the sixth day. The yield in that case amounted to about 40% of the total glucose supplied. The erythorbic acid concentration in the solution reached 80 g/l. The preferred temperature is about 30.degree. C.

Brief Summary Text (14):
In the course of typical fermentations the pH of the broth is gradually lowered along the consumption of sugar and remains in the range of 3.8-4.5. Erythorbic acid production reaches maximum yield at 5-7 days.

Brief Summary Text (15):
Working with washed cells at lower glucose concentrations show higher yields. In a test comparing fermentations starting with 1, 2 and 3% glucose (at 29.degree. C.), the following yields were found after 48 hours: about 80, 65 and 38% respectively. The initial pH was 5, decreasing to 4.0-4.3 at the end.

Brief Summary Text (18):
The method of separation described consumes acids and bases and forms salts (NaCl in this particular case), as an undesired by-product. In the fermentation liquor

the erythrobic is a mixture of the free acid form and a salt, depending on the final pH. Addition of Ba(OH).sub.2 according to the procedure suggested here, converts more of it into the salt form (using a barium salt instead of the base would avoid neutralization of free erythorbic acid, but would contaminate the solution with an anion of another acid). In the next stage all the erythorbate salt present in the solution is converted to the free acid form on a strong acid cation exchanger. More than one mole of a strong acid per mole of acidulated erythorbate are consumed for the regeneration of the cation exchanger. The erythorbic acid (free) containing solution is contacted with a weak base anion exchanger on which the acid is bound. On the elution of the adsorbed erythorbic acid more than one mole of HCl is adsorbed on the anion exchanger per mole of eluted erythorbic acid. Then at least one mole of base per mole of adsorbed HCl is used for the regeneration of the anion exchanger.

Brief Summary Text (19):
The recovery process described in the prior art thus suffers from several disadvantages. In order to separate erythorbic acid from the relatively dilute fermentation liquor at a reasonable concentration, it uses the chemical energy of the (indirect) neutralization of a mineral acid and mineral base (HCl and NaOH in the examples given above). As a result, costly reagents are consumed and an undesired salt is formed and there arises a need to dispose thereof. In addition, anions present in the fermentation liquor, mainly phosphate, are removed in a pretreatment, which could introduce traces of barium to the product and form barium salts which also require disposal. Cations present in the fermentation liquor are removed by strong acid cation exchangers, which also add to the salt production.

Brief Summary Text (22):
With the above-described state of the art in mind, according to the present invention there is now provided a process for the recovery of erythorbic acid from an aqueous feed solution containing values of erythorbic acid at a concentration of less than 0.7 mol/kg, comprising adsorbing a major portion of said erythorbic acid with a solid phase adsorbent resin selected from resins carrying a pyridine function and resins of similar or weaker basicity; separating said erythorbic acid-containing resin from residual aqueous solution, and subjecting said erythorbic acid-containing resin to a desorbing operation with a neutral solvent at a temperature of at least 20.degree. C. higher than the temperature at which said adsorption is carried out, whereby there is obtained a solution of erythorbic acid in solvent in which the concentration of erythorbic acid is at least equal to its concentration in said aqueous feed solution.

Brief Summary Text (30):
Kulprathipanja, in U.S. Pat. No. 4,720,579, proposes a process for separating citric acid from a fermentation broth by contacting with a polymeric adsorbent selected from the group consisting of an insoluble crosslinked polystyrene polymer and a non-ionic hydrophobic insoluble polyacrylic ester polymer at adsorption conditions selected to selectively adsorb said citric acid. In another patent, U.S. Pat. No. 4,851,573, Kulprathipanja proposes an adsorption process for separating citric acid from a fermentation broth by contacting with a water-insoluble, weakly basic, anionic exchange resin possessing tertiary amine or pyridine functional groups, at adsorption conditions selected to selectively adsorb said citric acid, desorbing said citric acid with a desorbent comprising water or a dilute inorganic acid at desorption conditions, said adsorption conditions including pH lower than the first ionization constant of citric acid. This patent directs a strong preference for desorption by a dilute sulfonic acid, because in some cases water is not strong enough to recover the adsorbed citric acid. Desorption with a neutral solvent at a temperature of at least 20.degree. C. higher than the temperature at which the adsorption is carried out, is not claimed or exemplified. In fact, the second patent states, "Desorption conditions will include the same range of temperature and pressures as used for adsorption conditions."

Brief Summary Text (32):
Said patent claims that the resin is effective, even if the temperature of adsorption is high (column 3, lines 53-55), teaching away from elution at elevated temperatures. Elution at a temperature higher than the adsorption temperature was not shown in the examples of said patent. Furthermore, methanol and acetone were used as the desorbing agents in the examples. A nearly complete recovery of the acid from its aqueous solution was not shown or claimed, particularly not with a resin after being used and eluted.

Brief Summary Text (33):
The invention of PCT Application No. WO 93/06226 is directed to an extractive fermentation of lactic acid, whereby broth is continuously removed from the fermentor, separated from the cells and passed through a polymer phase-containing pyridine group. The main goal is to maintain the pH and the lactate concentration in the fermentor at levels that reduce the product inhibition in the fermentor. Elution (desorption) of the adsorbed acid is very briefly referred to: "The adsorbed lactic acid can be recovered using a suitable desorbing agent. Suitable desorbing agents will include, for example, polar organic solvents such as alcohols (e.g., methanol) as well as hot water" (page 10, lines 19-22).

Brief Summary Text (34):
Example 6 of said PCT application uses 5% solutions of NH.sub.3, H.sub.2 SO.sub.4 or HCl for lactic acid desorption. Examples 2, 4 and 5 use methanol. No examples are given for the use of water for lactic acid desorption. No claim is made in said application to desorption at a temperature higher than that of the adsorption, or to obtaining the desorbed product at a temperature higher than that of the feed solution.

Brief Summary Text (35):
PCT Application WO 92/16490 relates to a process for recovering citric acid from a medium comprising it. In one preferred embodiment, the medium is contacted with a solid-phase, free base polymer having tertiary amine functions to adsorb citric acid, which is then desorbed by displacement with a strong acid, e.g., H.sub.2 SO.sub.4 or HCl. In another preferred embodiment, the medium is contacted with a solid phase, free base polymer having pyridine functions at a temperature below about 40.degree. C. to adsorb citric acid, which is then desorbed with hot water at a temperature of at least about 75.degree. C. No claim is made to achieving a product at a concentration higher than that of the feed.

Brief Summary Text (37):
In Example 3, a polyvinylpyridine resin was used in processes as described in Example 1, and the collected desorbed fluids were put back into the column after another saturation and rinse cycle, instead of water. The internal column temperature was brought to at least 85.degree. C. According to WO 92/16490, "Using that technique, a concentration of up to about 10% citric acid is achieved in two cycles. Additional cycles can be performed to further increase citric acid concentration, but in Applicant's work thus far, due to decreasing usable capacity of the resin with each cycle, the best efficiency has been achieved after two cycles." Thus, Example 3 teaches that in order to desorb citric acid at concentrations similar to those of the feed, desorbate should be recycled to desorption. As a result, the desorption is not completed and the resin loses capacity in the next cycle.

Brief Summary Text (40):
Erythorbic acid is not a carboxylic acid, and one could not draw analogies from other acids as to its behavior in adsorption on pyridine-based resins and in desorption. Yet, if such analogies could have been drawn, they would have indicated that product concentration on adsorption, followed by desorption at elevated temperature, is not attainable. An earlier publication by Reilly Industries, Inc. [Ernst and McQuigg, Paper No. 5AE, AICHE National Meeting (1992)] states: "The

shape of the 250 equilibrium curve is quite favorable for adsorption . . . The 900 curve has the same shape, which is not favorable for stripping . . . The design, developed by Advanced Separations Technologies, Inc., indicates a product stream of 9% citric acid from a feed of 16% citric acid in broth."

Brief Summary Text (41):
The above statement is made for adsorption at 25.degree. C. and desorption at 90.degree. C. The upper limit of the temperature range is determined in the case of citric acid by the various partial vapor pressures, by the overall pressure in the system and by the thermal stability of the resin. One should keep in mind that in the case of erythorbic acid, there is an additional limitation. Erythorbic acid tends to oxidize. This oxidation could be enhanced by elevated temperatures and by the contact with the resin.

Brief Summary Text (44):
It was found that in those cases where a part of the product is desired in a free acid form and another part in a form of a metal ion salt, a preferred combined process involves first desorbing erythorbic acid in acid form at the desired proportion by desorbing with water and then desorbing the rest with a solution comprising a base of the metal ion. Such a combination makes the desorbing with water more efficient. Thus, the temperature span between the adsorption temperature and that of the desorbing temperature could be smaller than in the case where all the adsorbed acid is desorbed with water. Alternatively, the same temperature span is used and the product of desorption with water is more concentrated. In such a preferred embodiment said desorption with a solution comprising a base of the metal ion can be effected at any convenient temperature, which does not need to be higher than that of adsorption.

Brief Summary Text (51):
In a preferred embodiment the erythorbic acid and the erythorbate salts, if present, are produced directly or indirectly by fermentation (i.e. erythorbic acid, erythorbic salts or a mixture thereof is the fermentation product, or is formed by the conversion of a fermentation product). In a further preferred embodiment the aqueous feed solution is a fermentation liquor. Such fermentation liquor is preferably treated prior to the adsorption step. Preferably such pretreatment consists of operations such as removal of biomass by methods known per se, e.g. centrifugation, filtration and membrane filtration. If desired, the solution is treated by an adsorbent such as an active carbon, diatomaceous earth or an adsorbing resin. Other pretreatments include ion exchange, solvent, extraction, etc.

Brief Summary Text (52):
In another preferred embodiment the aqueous feed is formed in an extractive fermentation. A solution out of the fermentor is transferred through said adsorbent resin to effect said adsorption step in which at least a part of the erythorbic acid present therein is adsorbed and the effluent is recycled to the fermentor, as is or after some treatment. In another preferred embodiment the acid in said solution out of the fermentor is adsorbed on a basic resin or extracted by a basic extractant. The basicity of those could be relatively high, if needed for efficient removal of the erythorbic acid from the solution, which is then recycled to the fermentor, as is or after some treatment. The adsorbed or extracted acid is stripped with a solution of a base to form a solution of an erythorbate salt, which forms the aqueous feed in the present invention, as is or after modification.

Brief Summary Text (57):
Japanese Patent 40-21767 describes a process in which ascorbic acid is produced, using an anion exchanger as a catalyst. The product acid is adsorbed on the anion exchanger and then eluted by treatment with acid, alkali or inorganic salt (solutions). The process of said patent is different from the process of the present invention, in that there is no step of adsorbing ascorbic acid and in that

the desorption is effected with acid and base solutions, while the present invention claims desorption with a neutral solution. Furthermore, said patent does not teach or suggest desorption at a temperature higher than that of adsorption, which is an essential feature of the present invention and desorption with a salt solution, as carried out in said patent, forms as a product a solution of ascorbate salt rathern than a solution of ascorbic acid, as formed according to the present invention.

Brief Summary Text (58):
Thus, as seen from the above discussion, the state of the art does not teach whether binding to the pyridine based resin and desorption at an elevated temperature is attainable without degradation of the erythorbic acid, and in fact, none of the above-mentioned publications teaches or suggests the process of the present invention.

Drawing Description Text (2):
In the drawing, FIG. 1 represents the isotherms of erythorbic acid adsorption at different temperatures.

Detailed Description Text (4):
FIG. 1 presents the isotherms of erythorbic acid adsorption on Reillex 425 at 30.degree. C. and 60.degree. C. The temperature effect is clearly seen--the adsorption at 60.degree. C. is less efficient than that at 30.degree. C. FIG. 1 also shows the favorable shape of the adsorption isotherms. Let the isotherm at 30.degree. C. represent the adsorption of erythorbic acid. Adsorption efficiency is high starting at very low aqueous phase concentrations, as shown e.g. by resin loading of about 0.6 mmole/g in equilibrium with aqueous solution of about 0.05 mmole/g (distribution coefficient >10). The curve is slightly concaved, which ensures complete adsorption of the erythorbic acid in a small number of counter--current stages. Let the isotherm at 60.degree. C. represent the desorption of erythorbic acid. While the desorption curve for citric acid, as found by the producer of the Reillex resins (Ernst and McQuibb), is strongly curved upward, that for erythorbic acid is slightly curved downward (and is even more so at somewhat higher temperatures), allowing for efficient stripping. Thus, as the producers of the resin found, their product provides for efficient adsorption, but is unfavorable for stripping. By analogy to liquid-liquid extraction with amine based extractants, one would expect citric acid to have the best combination of adsorption and stripping at higher temperature. It has now been surprisingly found that this combination for erythorbic acid is much better, providing for efficient adsorption and favorable stripping.

Current US Cross Reference Classification (1):
210/650

Other Reference Publication (1):
Shimizu et al., "Studies on Erythorbic Acid Production by Fermentation Part II. Erthorbic Acid Production by Jar Fermentor," Agr. Biol. Chem., vol. 31, No. 3, pp. 346-352 (1967).

Other Reference Publication (4):
Takahashi, "Erythorbic Acid Fermentation," Biotech. and Bioeng., vol XI, Issue 6, pp. 1157-1171 (1969).

Other Reference Publication (5):
Yagi et al., "Studies on Erythorbic Acid Production by Fermentation Part I. Erythorbic Acid-Producing Strain and Cultural Condition," Agr. Biol. Chem., vol. 31, No. 3, pp. 340-345 (1967).

CLAIMS:

1. A process for the recovery of erythorbic acid from an aqueous feed solution containing values of erythorbic acid at a concentration of less than 0.7 mol/kg, comprising:

adsorbing a major portion of said erythorbic acid with a solid phase adsorbent resin selected from resins carrying a pyridine function and resins of similar or weaker basicity;

separating said erythorbic acid-containing resin from residual aqueous solution, and

subjecting said erythorbic acid-containing resin to a desorbing operation with a neutral solvent at a temperature of at least 20.degree. C. higher than the temperature at which said adsorption is carried out,

whereby there is obtained a solution of erythorbic acid in solvent in which the concentration of erythorbic acid is at least equal to its concentration in said aqueous feed solution.

6. A process according to claim 1, wherein said aqueous feed solution containing values of erythorbic acid is obtained by fermentation.

18. A process for the recovery of erythorbic acid as claimed in claim 1, wherein said aqueous feed solution is a fermentation liquor.

19. A process for the recovery of erythorbic acid as claimed in claim 18, wherein said fermentation liquor is pretreated prior to said adsorbtion step.

21. A process for the recovery of erythorbic acid as claimed in claim 19, wherein said biomass removal is effected by membrane filtration.

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L6: Entry 1 of 3 File: USPT Feb 25, 2003

DOCUMENT-IDENTIFIER: US RE38009 E
TITLE: Zeaxanthin formulations for human ingestion

Brief Summary Text (7):
"Macular degeneration" is a medical term that applies to any of several disease syndromes which involve a gradual loss or impairment of eyesight due to cell and tissue degeneration of the yellow macular region in the center of the retina. Age-related macular degeneration (AMD) is the most common form of this type of disease. AMD affects millions of Americans over the age of 60, and is the leading cause of new blindness among the elderly. It is characterized and usually diagnosed by the presence of elevated levels of two types of cellular debris within the retina, called drusen and lipofuscin. These types of cellular debris may accumulate to abnormal levels for a number of reasons, including: (1) retinal cell damage caused by repeated exposure to too much light; (2) inherited genetic factors; (3) poor overall health of an individual; and (4) insufficient quantities of anti-oxidant compounds such as vitamins A, C, and E and selenium in a person's diet. Accumulation of drusen occurs within the capillaries and in the Bruck's membrane, and can impede the transport of oxygen and nutrients to the retinal tissues, and the removal of metabolic wastes from the tissues. Accumulations of lipofuscin occurs within a cellular layer which underlies the photoreceptors and which is responsible for nourishing, replenishing and removing wastes from these highly active visual cells. Accumulation of one or both of these types of debris can disrupt the normal metabolic and cellular processes which must occur in order to maintain retinal and visual health.

Detailed Description Text (7):
By way of illustration, the best lab-scale nutrient media disclosed in U.S. Pat. Nos. 5,308,759 and 5,427,783 contained corn flour (a granular powder that is difficult to work with), amylase and glucoamylase (to help digest the corn flour), lipase, and thiamine. During subsequent research to develop scale up the fermentations to commercial quantities, different culture media were developed by the Applicants which provide even better yields of zeaxanthin while requiring no corn flour, amylase, glucoamylase, lipase, or thiamine. The preferred commercial-scale fermentation media and methods disclosed in Example 1 can be sealed up to virtually any desired volume, and they will cause the F. multivorum strain isolated by the Applicants to generate large quantities of R-R zeaxanthin. Most of the zeaxanthin remains inside the cells and is effectively bound to the cell membranes.

Detailed Description Text (9):
Example 3 discloses a series of steps that can be used to remove and partially purify the zeaxanthin from the bacteria. These steps can be broken down into four main processes: (1) killing the bacterial cells, using means such as heat (pasteurization); (2) breaking the bacterial cells apart by rupturing their cell membranes, to render the zeaxanthin more accessible; (3) removing the zeaxanthin from the cell and nutrient solids, by using a solvent-extraction process; and (4) evaporating the solvent, which leaves behind an oily mass that contains partially-purified zeaxanthin.

Detailed Description Text (29):

In the opposite direction (i.e., using fewer purification steps and stopping short of creating the semi-pure oily liquid described in Example 3), it may be possible to add intact F. multivorum cells containing zeaxanthin directly to one or more foods intended for human consumption. Numerous human foods (including cheese, yogurt, beer, and certain types of milk that have had acidophilus bacteria or other microbes added) contain intact microbial cells, and there is no known pathogenicity associated with the F. multivorum cells isolated by Applied Food Biotechnology, Inc. These cells are gram-negative bacteria, and do not have the cell wall structures that characterize gram-positive bacteria. In addition, since they were isolated from a relatively cold artesian waterway, they are adapted to living in cold water and cannot survive or reproduce well at temperatures inside the human body. When fed directly to animals such as poultry and fish, these cells apparently are well-suited as delivery vehicles for zeaxanthin; after ingestion, the zeaxanthin is released when the cells are digested, absorbed into the bloodstream through the intestinal walls, and deposited into various animal tissues at expected and appropriate locations. Accordingly, intact F. multivorum cells containing the R-R stereoisomer of zeaxanthin, and which can be killed by a process such as pasteurization if desired, may be suitable for direct human consumption, if desired, in a suitable carrier substance such as yogurt, cheese, milk, or beer.

Detailed Description Text (59):
After the stabilizing compounds are added, the cell culture is pasteurized by heating to 65.degree. C. for 25 to 50 minutes. This kills the bacterial cells without damaging the zeaxanthin they have produced. The culture is then cooled to room temperature, and the zeaxanthin-containing cells and other solids present in the culture broth are separated from the liquid phase by means of a cross-flow microfiltration system which increases the cells/solids concentration from an initial value of about 10 to 15%, to a filtered concentration of about 60 to 80%, by volume. This procedure results in a cell paste, which also contains some residual solids from the nutrient medium.

Detailed Description Text (63):
After a cell paste has been created as described in Example 2, it can be treated in any of a variety of ways. As mentioned in the Description of the Preferred Embodiments, the cell membranes can be disrupted if desired, to break open the cells and render the zeaxanthin more accessible, by means such as sonication (high-frequency sound waves), high pressure, or grinding, keeping the temperature of the cells below about 30.degree. C. to prevent oxidation. However, this step has not been necessary when tetrahydrofuran (THF) is used in a solvent extraction step, since THF is quite effective in disrupting the cell membranes without mechanical assistance. Stirring has not been necessary when THF is used in lab-scale operation; however it is likely that stirring during the solvent mixing step would probably be beneficial in commercial-scale operations.

Detailed Description Text (64):
In tests done to date, THF extraction involved mixing about 8 to 20 volumes of purified filtered THF with a volume of cell paste containing 60-80% solids, at a temperature below 25.degree. C., for a period of 2 to 24 hours. The THF aggressively attacks the cells, creating a liquid fraction with what is, in essence, a suspension of flocculent solids in the liquid. The majority of the THF is removed by decanting, which can follow centrifugation at up to 20,000 gravities for several minutes. The THF that remains after decanting can be evaporated at room temperature under full vacuum, to leave behind a viscous oily mass which usually contains about 10% zeaxanthin by weight. Zeaxanthin content in the oily fluid has ranged from about 5 to 20% zeaxanthin, when cell pastes containing 1 to 3% zeaxanthin are treated by THF extraction in a single-pass operation.

Detailed Description Text (88):
Some of the test birds will be subjected to high-intensity light at 12,000 lux for a single period, which initially will range from 2 to 8 hours for several initial

groups of trial birds. This high-intensity exposure is expected generate a level of retinal damage that will be severe in carotenoid-deficient birds while being less severe in carotenoid-normal birds. If initial tests indicate that the level of damage is either too low or too high to be optimal for analytical purposes, the exposure period will be lengthened or shortened accordingly. The light bulbs will be behind cooling devices, to ensure that ambient temperatures do not affect the outcome. Birds will be sacrificed at various times over a 7 day period after exposure to the high-intensity lights. In addition, in each of the diet and treatment groups, various birds will be sacrificed at stages which allow evaluation of the effects of diets and treatments as a function of aging.

Current US Cross Reference Classification (21):
426/61

Previous Doc Next Doc Go to Doc#

L2: Entry 20 of 25 File: USPT May 16, 1989

DOCUMENT-IDENTIFIER: US 4830753 A
TITLE: Membrane filtration of cell culture media with charged particles

Abstract Text (1):
In the membrane filtration of a liquid cell culture medium, superior flux rates and product recovery are obtained when a first charged particulate material and optionally a second charged particulate material bearing a charge opposite that of the first material are sequentially added to the medium prior to filtration.

Brief Summary Text (2):
This invention relates to a method for filtering liquid cell cuture media, such as fermentation broths, using charged particles as filtering aids and, more particularly, to membrane filtration methods in which the charged particles are combinations of microsized positively and negatively charged particles.

Brief Summary Text (4):
The use of charged particles as filtering aids in the membrane filtration of liquid cell culture media such as fermentation liquors is known. U.S. Pat. No. 4,200,659 to Chong et al describes flocs prepared by mixing microsized, positively and negatively charged particles and the use of these preformed flocs as filtering agents for fermentation broths, and suggests that negatively or positively charged particles individually may be ultrafiltered within the lumens of fine hollow fibers (col. 9, line 59 to col. 10, line 44). In another context (col. 12, lines 17-30), the Chong et al. patent describes preparation of the flocs in the liquid to be treated and filtered by adding negatively and positively charged particles to the liquid.

Brief Summary Text (8):
Such as an advantage is a 20% to several-fold increase in flow rate through a filtration membrane, resulting at least partially from a substantial reduction in the formation of secondary layers of particles and/or solutes on the membrane surface (the concentration polarization phenomenon) which tend to gelatinize and to foul the membrane, and partially from a change in the membrane rejection coefficient. The commercial advantage of such an advantage is readily apparent.

Brief Summary Text (9):
In this specification, the expression "cell culture medium" means a fermentation broth, i.e., the liquid medium in which biological substances are ~~grown, or~~ filtrates or liquid fractions obtained from fermentation broths, including or excluding cells, cell debris and other material resulting from cell lysis, if practiced. The biological substances include plant, animal and microbial cells, genetically engineered cells, and products thereof.

Brief Summary Text (13):
Fermentation broths which may be filtered according to the invention are produced by growing fungi, yeasts, bacteria or other cells of biological origin in conventional liquid culture media. After microbial growth and fermentation are finished, the broth will contain cells, cell debris, spent nutrients, biological products and various contaminants. The broths may themselves be filtered in accordance with the method of the invention or the solid material may first be

removed by centrifugation, conventional filtration or other separation techniques and the invention practiced on the supernatant or any fraction thereof. The invention may also be practiced both on the fermentation broth and on any liquid portions or fractions thereof, including the supernatant.

Brief Summary Text (14):
The particular charged particles to be used in any given case is a matter of selection, based on well-known principles of microbiology and fermentation biochemistry in light of the charge and charge densities of solids and solutes in the cell culture media, and is easily made by one skilled in these arts. The terms "charged particle" and "charged particulate material" as used herein, are understood to include all particles bearing charges that are available for interaction with other components in a liquid medium, including charges limited to the particle surface; it includes both deliberately functionalized particles and those with naturally occurring charges, as well as particles both soluble and insoluble in the liquid medium.

Brief Summary Text (19):
In summary, the transmembrane flux rate of cell culture media is vastly improved by use of the combined, microsized, charged particles in accordance with the invention, the high flux rate remaining constant, in some cases, over at least a five-fold concentration of the medium. At the same time, when the invention is practiced on media containing proteins, enzymes and other products to be purified or recovered, there is decreased concentration polarization and reduced rejection of these products by the membrane filtration, which results in a more complete separation and improved recovery of the products. These benefits depend on formation of a floc upon addition of the first charged particulate material; additional benefits depend on stabilization of the floc by subsequent addition of the second charged particulate material. The stabilization is believed to result from the linking of complex cells (or other materials), positively charged particles, solutes and negatively charged particles through ionic interactions. It is believed that the floc adsorbs and removes from the liquid medium those components that are responsible for low flux rates in untreated media. Even in those cases in which the viscosity of the cell culture medium increases in the presence of the floc, the resultant decreases in flux rate are counteracted by decreases in formation of gel layers on the membrane caused by concentration polarization.

Brief Summary Text (26):
Examples 1 and 2 describe the effects on flux rate and protein recovery of treatment of a fermentation broth with Resin A and Resin B, respectively, for comparison with treatments of the combined resins (Example 3). Example 4 describes ultrafiltration of fermentation broths treated with the combined resins, and concentration by ultrafiltration of the separated, resuspended flocs. Example 5 shows flux rates and protein recovery when particle-free supernatants of the preparation of Example 4 are ultrafiltered with the combination of resins. Example 6 is similar to Example 5 but shows effects of the combined resin ultrafiltration on cell-free supernatants. Examples 7 and 8 show the effect on ultrafiltration and microfiltration flux rates, respectively, of a fermentation broth treated with Resin A. Example 9 shows the effect of other small anion exchange resins on microfiltration of a fermentation broth. Examples 10 and 11 show the effect of combined Resins A and B and on ultrafiltration and microfiltration of a yeast cell suspension, while Example 12 shows the effect of combined Resins A and B on microfiltration of an albumen sample.

Detailed Description Text (2):
Whole cells of Bacillus licheniformis, ATCC 21415, were grown on a liquid medium containing 3% starch, 1% glucose, 5% soybean meal hydrolysate, 1% ammonium phosphate, 0.03% potassium chloride and 0.02% magnesium sulfate at 30.degree. C. and pH 7.0 for four days. The final dry cell weight was 10 g/liter. At the end of

culivation, 1 liter of crude fermentation broth was concentration by ultrafiltration at room temperature through using a hollow fiber filtration module with porosity of 100,000 MW (Romicon HF-1-43 PM 100). The hollow fiber module consists of membranes made from polysulfone. This module has twenty-five fibers with an internal diameter of 1.1 mm, a surface area of 930 cm.sup.2 and a length of 40 cm. The operating parameters used were a mean transmembrane pressure of 117 kPa and recirculation flow rate of 2 liters/min.

Detailed Description Text (3):
The average flux permeate rate was measured and compared with those obtained when a floc formed by the addition of Resin A was added to the fermentation broth. The initial extracellular protein, the protein adsorbed in the membrane and the protein rejection were also determined.

Detailed Description Text (12):
The protein effectively rejected by the membrane is defined as the total amount of protein present in the concentrate fraction plus the total protein in the concentration polarized gel layer associated with the membrane. The protein in the gel layer (.DELTA.P) is obtained by difference between the total protein present in the cleared supernatant of the starting broth and the sum of the protein in the filtrate (permeate) and the cleared concentrate after filtration. Protein rejection in this and subsequent examples is expressed as the percentage of the starting protein in solution that was not recoverable in the filtrate; the calculation is: ##EQU2## where P.sub.f =the protein, in milligrams, in the filtrate fraction

Detailed Description Text (17):
(A). Cell cultivation was carried out for 48 hours essentially as described in Example 1. The resulting dry cell weight was 4 g/liter. To 1 liter of the fermentation broth were added Resin A and then Resin B to final 0.25% and 0.10% concentrations, respectively. The control sample was 1 liter of the fermentation broth.

Detailed Description Text (24):
Whole cells of Bacillus sp., ATCC 21536, were grown on a liquid medium containing 2% starch, 0.5% yeast extract, 0.5% peptone, 0.1% monopotassium phosphate, 0.02% magnesium sulfate and 1% sodium carbonate at 37.degree. C. and pH 10.0 for three days. The final dry cell concentration, determined by precipitating the cells in a broth sample, washing the cell pellet, drying it at 80.degree. C. for 30 hours and weighing it, was 4.6 g/liter. At the end of cultivation, one liter of crude fermentation broth was concentrated by ulrafiltration as described in Examples 1 and 3. The resins used and results are given in Table 7, and show that a substantial improvement (41%) in flux rate was obtained when Resin A was added to the fermentation medium. The flux was increased 59.3% by adding Resin B to the floc previously formed with Resin A.

Detailed Description Text (26):
The procedure of Example 7 was repeated example that the whole fermentation broth was concentrated by microfiltration at room temperature using a hollow fiber filtration module with a porosity of 0.1 .mu.m (Romicon HF-1-47MP). This module has twenty-five fibers with an internal diameter of 1.1 mm, a surface area of 930 cm.sup.2 and a length of 40 cm. The average permeate flux rate was measured and compared with those obtained when Resin A was added to the Bacillus sp. fermentation broth. The results of the measurements are given in Table 8, from which it may be seen that an improvement of 55% in flux rate was obtained over the control.

Current US Cross Reference Classification (1):
210/650

CLAIMS:

1. An improved method for separating components of a liquid cell culture medium by membrane filtration which comprises:

(a) introducing into the medium an effective amount of a first charged, particulate material bearing 0.1-1.5 functional groups per monomer unit and having an average diameter of from about 0.01 to about 2.5 micrometers, to form a suspension in the medium, and

(b) subjecting the medium containing the suspension to membrane filtration.

6. The method of claim 2 wherein the liquid cell culture medium comprises a fermentation broth.

7. The method of claim 6 wherein the fermentation broth is of a bacterium.

8. The method of claim 6 wherein the fermentation broth is of a yeast.

11. The method of claim 1 wherein the liquid cell culture medium comprises a fermentation broth.

12. The method of claim 11 wherein the fermentation broth is of a bacterium.

13. The method of claim 11 wherein the fermentation broth is of a yeast.

14. An improved method for separating components of a liquid cell culture medium by membrane filtration which comprises:

(a) introducing into the medium an effective amount of a first charged, particulate material bearing 0.1-1.5 functional groups per monomer unit and having an average diameter of from about 0.01 to about 2.5 micrometers, to form a suspension in the medium,

(b) introducing into the medium an effective amount of a second charged particulate material bearing a charge opposite that of the first particulate material, bearing 0.1-1.5 functional groups per monomer unit and having an average diameter of from 0.01 to about 2.5 micrometers,

(c) separating solid components from the medium,

(d) resuspending said solid components in a second, aqueous, liquid medium, and

(e) subjecting the second aqueous liquid medium to membrane filtration.

15. An improved method for separating components of a liquid cell culture medium by membrane filtration which comprises:

(a) introducing into the medium an effective amount of a first charged, particulate material bearing 0.1-1.5 functional groups per monomer unit and having an average diameter of from about 0.05 to about 2.5 micrometers, to form a suspension in the medium,

(b) introducing into the medium an effective amount of a second charged particulate material bearing a charge opposite that of the first particulate material, bearing 0.1-1.5 functional groups per monomer unit and having an average diameter of from 0.01 to about 2.5 micrometers,

(c) separating solid components from the medium, and

(d) subjecting the medium to membrane filtration.

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☐ 21. Document ID: US 4790942 A

L2: Entry 21 of 25 File: USPT Dec 13, 1988

US-PAT-NO: 4790942
DOCUMENT-IDENTIFIER: US 4790942 A

TITLE: Filtration method and apparatus

DATE-ISSUED: December 13, 1988

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Shmidt; Iosif	Brookyn	NY		
Badiali; Mario	Bronx	NY		

US-CL-CURRENT: 210/650; 210/321.63, 210/321.64, 210/321.68, 210/321.87, 210/391, 210/784, 422/101, 436/178, 73/61.41

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 22. Document ID: US 4738782 A

L2: Entry 22 of 25 File: USPT Apr 19, 1988

US-PAT-NO: 4738782
DOCUMENT-IDENTIFIER: US 4738782 A

TITLE: Method and apparatus for aseptic filtration

DATE-ISSUED: April 19, 1988

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Yamauchi; Hiroaki	Kakogawa			JP
Shiotani; Takeshi	Kobe			JP
Mekata; Yoshimitsu	Takasago			JP
Imai; Satoshi	Kobe			JP

US-CL-CURRENT: 210/650; 210/321.84, 210/500.36, 210/651, 435/309.2, 435/800, 528/488, 528/490, 528/493

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

☐ 23. Document ID: US 4581236 A

L2: Entry 23 of 25 File: USPT Apr 8, 1986

US-PAT-NO: 4581236
DOCUMENT-IDENTIFIER: US 4581236 A
** See image for Certificate of Correction **

TITLE: Process and apparatus for reduction of alcohol by dialysis in fermented beverages

DATE-ISSUED: April 8, 1986

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bandel; Werner	Wuppertal			DE
Schmitz; Franz J.	Erlenbach			DE
Ostertag; Karl	Erlenbach			DE
Garske; Friedrich	Wuppertal			DE
Breidohr; Hans G.	Wuppertal			DE

US-CL-CURRENT: 426/14; 210/641, 210/645, 210/648, 210/650, 210/669, 426/16, 426/592

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

☐ 24. Document ID: US 4222874 A

L2: Entry 24 of 25 File: USPT Sep 16, 1980

US-PAT-NO: 4222874
DOCUMENT-IDENTIFIER: US 4222874 A

TITLE: Balanced pressure tubular molecular filtration system

DATE-ISSUED: September 16, 1980

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Connelly; Robert F.	Tokyo 107-91			JP

US-CL-CURRENT: 210/650; 210/321.87, 210/409, 210/652

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

☐ 25. Document ID: US 3974068 A

L2: Entry 25 of 25 File: USPT Aug 10, 1976

US-PAT-NO: 3974068
DOCUMENT-IDENTIFIER: US 3974068 A
** See image for Certificate of Correction **

TITLE: Ultrafiltration process and apparatus using low hydrostatic pressure to prevent concentration polarization

DATE-ISSUED: August 10, 1976

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ebner; Heinrich	Bonn			DT
Enenkel; Anton	Bonn			DT

US-CL-CURRENT: 210/637; 210/321.84, 210/650, 210/777

Terms	Documents
(210/650).ccls. and L1	25

L2: Entry 2 of 25 File: USPT Nov 18, 2003

DOCUMENT-IDENTIFIER: US 6648978 B2
TITLE: Membrane filtration for thickening and starch washing in corn wet milling

Abstract Text (1):
An improved corn wet milling process is disclosed in which a first stream comprising water, starch, and protein (e.g., gluten) is generated by separating fiber from wet milled de-germed corn particles (e.g. fiber separation step). Membrane filtration (e.g. starch-protein stream thickening) is performed on the first stream, producing a first retentate and a first aqueous permeate. The first retentate (e.g. thickened starch-protein stream) is separated into a second stream and a third stream (e.g. primary starch separation step). The second stream comprises water and a majority of the starch present in the first retentate, and the third stream comprises water and a majority of the protein (e.g., gluten) present in the first retentate. This process provides an economical means of recovering a higher percentage of the available cornstarch for inclusion in high value products.

Brief Summary Text (9):
The gluten stream from the primary separation step typically comprises about 3 to 5% (by weight) dry solids, which can be thickened and concentrated mechanically or by membrane filtration. The concentrated and dewatered stream is then sent to a gluten drier, to remove most of the remaining water (e.g., to about 90-95% dry solids). The dry end product is corn gluten meal.

Brief Summary Text (11):
A post-wet milling treatment of recovered starch involves hydrolyzing it to produce glucose (dextrose) and other oligosaccharides, which can in turn be used as carbon sources in fermentations from which products like ethanol and organic acids, among others, can be recovered. Furthermore clarified dextrose produced from starch can itself be sold as a sweetener or can be converted (e.g. via enzymatic treatment) to high fructose syrups, which can also be used as sweeteners. Alternatively, starch recovered from the corn wet milling that has been chemically treated (e.g. hydroxyethylated dent corn starches and thinned unsubstituted waxy maize starches) can be used in paper coating formulations to give the required rheology, water holding, and binding properties to the coating formulation.

Brief Summary Text (15):
The present invention is directed to a corn wet milling process that comprises the steps of (1) separating wet milled de-germed corn particles into a fiber component and a first stream comprising water, starch, and protein (e.g. fiber separation step); (2) performing membrane filtration of the first stream (e.g. starch-protein stream thickening) producing a first retentate and a first aqueous permeate; (3) and separating the first retentate (e.g. thickened starch-protein stream) into a second stream and a third stream (e.g. primary starch separation step), wherein the second stream comprises water and a majority of the starch present in the first retentate, and the third stream comprises water and a majority of the protein present in the first retentate. The corn wet milling process of the present invention can comprise additional steps between membrane filtration and separating the first retentate. A majority in the present invention refers to an amount that is greater than 50% of the starting material. Thus, for example, the second stream

comprises more than half of the starch that was present in the first retentate (thickened starch-protein stream).

Brief Summary Text (17):
Certain embodiments of the present invention further comprise membrane filtration (e.g. clarification) of the fifth stream (e.g. the aqueous wash media) to produce a second retentate (e.g. comprising recovered starch lost from the fourth stream) and a second aqueous permeate having less than about 2% dry solids (e.g. clarified wash media). The second retentate can be combined with the first retentate (e.g. thickened starch-protein stream) prior to the primary starch separation step, and the second aqueous permeate can be combined with the first stream prior to thickening (e.g. membrane filtration of the of starch-protein stream).

Brief Summary Text (19):
Embodiments of the present invention permit the replacement of other separation equipment and techniques, such as centrifuges, with membrane filtration systems for the recovery and/or concentration of starch in certain aqueous streams in a corn wet milling process. Up to about 3.times. concentration and possibly more of the dry solids in the first stream comprising starch and protein (e.g., gluten) can be achieved using membrane filtration.

Drawing Description Text (6):
FIG. 4 is a graph of flux (0.2 micron membrane, 0.005 micron membrane .box-solid.) and concentration factor (.diamond-solid.) data versus time for Example 2 in which ceramic membranes were used in place of a clarifier at a temperature of about 130 degrees F. Treatment conditions were CeraMem (2-mm, 1.5 ft.sup.2), 130.degree. F., .DELTA.P=5 psi, TMP=17.5, and initial volume=10 liters.

Drawing Description Text (7):
FIG. 5 is a graph of total solids versus concentration factor for (retentate .diamond-solid., permeate of 0.2 micron membrane .circle-solid.) Example 2 in which a ceramic membrane was used in place of a clarifier at a temperature of about 130 degrees F.

Drawing Description Text (8):
FIG. 6 is a graph of flux (0.2 micron membrane .circle-solid.) and concentration factor (.box-solid.) data versus time for Example 2 in which ceramic membranes were used in place of a clarifier at a temperature of about 115 degrees F. Treatment conditions were CeraMem AG1180 (0.2 micron, 2-mm, 1.5 ft.sup.2), 115.degree. F., .DELTA.P=5 psi, TMP=22.5, and initial volume=14.4 liters.

Drawing Description Text (9):
FIG. 7 is a graph of total solids versus concentration factor (retentate .diamond-solid.) permeate .circle-solid.) for Example 2 in which ceramic membranes were used in place of a clarifier at a temperature of about 115 degrees F.

Detailed Description Text (4):
Wet milled de-germed corn particles 16 are subjected to fiber separation through washing and screening and fiber 17 is removed. The other product of the fiber separation step is a first stream 18 comprising starch and protein (e.g., gluten). The first stream typically comprises about 10% to 20% dry solids (ds). The first stream 18 next undergoes thickening using membrane filtration.

Detailed Description Text (5):
Membrane filtration (e.g. thickening) of the first stream 18 results in a first retentate 19 and a first aqueous permeate 27. The first aqueous permeate 27 comprises up to about 5% (by weight) dry solids and can be recycled to the steep tanks. Preferably the first stream 18 is concentrated up to about a factor of about 3 in the first retentate 19. The first retentate 19 is greatly enriched in starch and gluten (e.g. they are concentrated or thickened) relative to the first stream

18. The first retentate can comprise about 20% to 35% ds. The % ds in the first retentate 19 is greater that that of the first stream 18.

Detailed Description Text (6):
The membrane filtration of the first stream 18 is accomplished using at least one microfiltration membrane selected from the group consisting of spiralwound membranes, tubular membranes, and polymeric or inorganic membranes. Ceramic membranes, like those from CeraMem (Waltham, Mass.), USFilter (DeLand, Fla.), PCI (England), and Gravier (GlassGow, Del.) are particularly preferred. Preferably, the one or more microfiltration membranes used for thickening the first stream 18 have a pore size of between about 0.005 microns and 0.2 microns. Ceramic membranes with about 2 to 6 mm channels are preferred. It is preferred that a transmembrane pressure of between about 15 and 75 psi be maintained during membrane filtration of the first stream. The flux across the membrane during membrane filtration of the first stream 18 preferably varies from between about 4 to 50 GFD (gallons/ft.sup.2 /day), depending on the pore size of the membrane and operating conditions. For example, under equivalent conditions of membrane filtration of the first stream (both membranes having 2 mm channel size and 1.5 ft.sup.2 of surface area and a transmembrane pressure maintained at about 17.5 psi and pressure drop of 5 psi with a system temperature of about 120.degree. F.) a CeraMem membrane having a pore size of 0.005 microns can have a flux of between about 4 to 6 GFD, while a CeraMem membrane having a pore size of 0.2 microns can have a flux between about 20 to 50 GFD. Furthermore flux tends to decrease somewhat as the retentate becomes more concentrated.

Detailed Description Text (7):
The first retentate 19 (e.g. thickened first stream from the membrane filtration) is subjected to a primary starch separation step which can be accomplished by centrifugation and which yields a second stream 21 comprising the majority (e.g. >50% by weight) of the starch and a third stream 20 comprising the majority of the gluten from the first retentate 19. The third stream 20, which is rich in gluten, can be further processed for use in such products as corn gluten meal.

Detailed Description Text (9):
The fourth stream 24 comprises about 30% to about 40% ds and can then undergo dewatering, yielding a sixth stream 25 (e.g. recovered starch stream with between about 40% and 60% ds) which can be dried or can undergo further treatment or modification. Dried starch can be an end product or the dried starch can undergo further treatment or modification (e.g. thinning). The fifth stream 22 comprising the wash media from the starch washing step preferably comprises greater than about 85 wt % water and up to about 15% dry solids (wherein the dry solids comprise starch), and it can further undergo membrane filtration, to clarify it.

Detailed Description Text (10):
The second retentate 23 of the membrane filtration of the fifth stream (e.g. wash media) which comprises the majority of the starch that was present in the fifth stream 22 along with gluten and impurities, can then be combined with the first retentate 19 prior to the primary starch separation step to undergo another round of primary starch separation and washing. Typically, the second retentate 23 can comprise between about 20% and 30% dry solids comprising starch, among other components, which can represent up to about a 3 fold higher concentration of dry solids than is present in the fifth stream 22. Membrane filtration of the fifth stream 22 also results in a second aqueous permeate 28 that can comprise less than about 2% ds. This second aqueous permeate 28 can be combined with the first stream 18 (e.g. starch-protein stream prior to thickening).

Detailed Description Text (11):
Preferably the membrane filtration of the fifth stream 22 is performed using at least one microfiltration membrane selected from the group consisting of spiralwound membranes, tubular membranes, ceramic membranes and inorganic

membranes. Inorganic membranes (such as those available from CeraMem) and spiralwound membranes (such as those available from Koch (Wilmington, Mass.)) are preferred, and ceramic membranes are particularly preferred.

Detailed Description Text (12):
Preferably, the one or more microfiltration membranes used for thickening the fifth stream 22 have a pore size of between about 0.005 microns to about 0.2 microns. Ceramic membranes with about 2 to 6 mm channels are preferred for filtration of the fifth stream 22, as are spiralwound membranes with a spacer of between about 80 mil and 120 mil (e.g. Koch 3838-MFK-618-FYT). If the membrane used is a CeraMem membrane, it is preferred that a transmembrane pressure of between about 17 and 75 psi be maintained during membrane filtration of the fifth stream 22, more preferably the transmembrane pressure is between about 17 and 43 psi. The flux across a CeraMem membrane during membrane filtration of the fifth stream 22, in some embodiments, can vary from between about 8 to 26 GFD (gallons/ft.sup.2 /day), depending on the pore size of the membrane. For example, under equivalent conditions of membrane filtration of the fifth stream 22 (both membranes having 2 mm channel size and 1.5 ft.sup.2 of surface area and a transmembrane pressure maintained at about 17.5 psi and pressure drop of 5 psi with a system temperature of about 130.degree. F.) a CeraMem membrane having a pore size of 0.005 microns can have a flux of between about 15 to 8.5 GFD, while a CeraMem membrane having a pore size of 0.2 microns can have a flux between about 26 to 18 GFD. Flux can fall off as the retentate becomes more concentrated.

Detailed Description Text (24):
FIGS. 2 and 3 show data obtained with the CeraMem membranes. Both membranes were operated together in the same batch recycle system in parallel (retentate returned to the feed tank, permeate removed from the system). FIG. 2 shows an initial flux of about 62 GFD dropping to about 20 GFD at 3.times. concentration (about 34% TS) with the 0.2.mu. membrane. The tighter membrane gave about 5 GFD at all .times. (concentration) values. Above 3.times., it became impossible to control the temperature at about 120.degree. F. and there was a runaway gelatinization in the pump and all the piping (the pump impeller actually stopped turning when an attempt was made to push the concentration level above 3.times.). The retentate sample dug out from inside the pump head and piping had a TS of 43.5%.

Detailed Description Text (27):
Thus the mill stream thickener centrifuge could be replaced with a membrane filtration process. The membrane process can result in higher solids and lower flow rate to the primary starch separator (PSS), and a cleaner permeate with no suspended solids going to the steep tanks. It is predicted that a feed stream of about 17 wt % total solids at a flow rate of about 2150 GPM undergoing membrane filtration using a ceramic filter achieves about a 2.times. level of concentration of the stream and a flux of about 20 GFD. The retentate (e.g., thickened stream) comprises about 30 wt % total solids and has a flow of about 1075 GPM to the primary starch separator. The permeate is recycled to the steep tanks at a flowrate of about 1075 GPM with about 4 wt % total solids.

Detailed Description Text (35):
Data obtained with the Koch spiral membrane is shown in FIGS. 8 and 9. Two feed-and-bleed (3.times.) runs were done with the same clarifier feed at different transmembrane pressure. As expected for membrane filtration, higher pressures initially resulted in higher flux (about 35 GFD vs. about 26 GFD) but resulted in lower flux within a couple of hours. Total solids of retentate at about 3.times. was about 27 to 28 wt % TS while permeate TS was about 1.3 to 1.6 wt %.

Detailed Description Text (36):
Thus it is expected that using a "membrane clarifier", a 3.times. to 4.times., and possibly even 5.times. volume concentration should be possible with tubular ceramic membranes with 4-6 mm diameter channels. Conditions predicted in a corn wet milling

process involving a membrane clarifier involve starch washings flowing to the membrane at a rate of about 1000 GPM with about 12.5 wt % total solids. If the membrane is a spiral membrane, the flux is about 10 GFD and if it is a ceramic membrane, the flux is about 30 GFD. The volume concentration factor is between about 3 and 5 and the total solids concentration factor is about 2.2. The predicted flow rate of the concentrated starch washings from the membrane filtration step to the primary starch separator is about 333 GPM with about 27 wt % total solids. The recovered aqueous media from the membrane filtration is predicted to have a flow rate of about 667 GPM and about 1.5 wt % TS.

Detailed Description Text (40):
The starch slurry used in the diafiltration tests was prepared by adding about 75 pounds dry starch to about 13 gallons water to arrive at a final volume of about 15 gallons. Starch slurry .degree. Be was measured at about 20 which correlates to about 35 wt % dry substance (TS). Crosslinked waxy starch was used for these runs but any suitable starch could have been used. The starch slurry had a flowrate of 30 GPM to the membrane, the retentate with a flowrate of about 30 GPM was recycled to the starch slurry stream. Fresh water was added at a flowrate of about 0.2 GPM to the retentate/starch slurry stream before another round of membrane filtration. The permeate removed by the membrane filtration had a flowrate of about 0.2 GPM.

Current US Cross Reference Classification (4):
210/650

CLAIMS:

1. A corn wet milling process comprising: separating wet milled de-germed corn particles into a fiber component and a first stream comprising water, starch, and protein; membrane filtration of the first stream, producing a first retentate enriched in starch and protein and a first aqueous permeate; and separating the first retentate into a second stream and a third stream, wherein the second stream comprises water and a majority of the starch present in the first retentate, and the third stream comprises water and a majority of the protein present in the first retentate.

6. The process of claim 1, wherein the membrane filtration of the first stream is done with at least one microfiltration membrane selected from the group consisting of spiralwound membranes, tubular membranes, ceramic membranes, and inorganic membranes.

9. The process of claim 6, wherein the transmembrane pressure during membrane filtration of the first stream is between about 15 psi and 75 psi.

11. The process of claim 2, further comprising membrane filtration of the fifth stream to produce a second retentate and a second aqueous permeate, and wherein the second retentate is combined with the first retentate, and the second aqueous permeate combined with the first stream.

15. The process of claim 11, wherein the membrane filtration of the fifth stream is done with at least one microfiltration membrane selected from the group consisting of spiralwound membranes, tubular membranes, ceramic membranes, and inorganic membranes.

18. The process of claim 15, wherein the transmembrane pressure during membrane filtration of the fifth stream is between about 17 and 75 psi.

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L8: Entry 1 of 13 File: USPT Sep 2, 2003

DOCUMENT-IDENTIFIER: US 6613366 B1
TITLE: Enzyme-rich sprouted food products with limited pH drop and methods of making same

Abstract Text (1):
A class of food products whose nutrients have not been damaged by heat during the preparation process. These products are prepared with methods to limit souring thus permitting these food products to be prepared at a temperature low enough to minimize damage to vital nutrients (especially enzymes) without the objectionable excessive sourness and bitterness of similar products prepared without such methods. The result is a new class of delicious and nutrient rich health food products with many health benefits. Also disclosed is a Wet Grain Press for quickly and easily compressing very wet sprouts.

Brief Summary Text (2):
This invention relates in general to food products one of whose ingredients is edible sprouts, and more particularly to such food products which are prepared with methods to limit bacterial souring thus permitting these food products to be prepared at a temperature low enough to minimize damage to vital nutrients (especially enzymes) without the objectionable sour and bitter taste of background art products prepared without such methods. These methods do not involve either cooking or the use of chemical preservatives both of which are strongly objected to by those who have switched to an all-raw food diet.

Brief Summary Text (3):
This invention also relates to such food products which are prepared using low temperature water activity reduction methods to prevent souring and fungal growth. Being low temperature methods, heat damage to vital nutrients is minimized, and the shelf-stable food products thus produced are rich in health benefits. The methods and associated apparatus for producing these products are suitable for processing those sprouted seeds which require processing to modify their structure in order to make them suitable for human consumption. The types of structure modification contemplated herein include compression or flattening, weakening of the internal structure through prolonged soaking, and fracturing the internal structure through freezing.

Brief Summary Text (5):
Ever since the publication of Dr. Edward Howell's book The Status of Food Enzymes in Digestion and Metabolism in 1946 (published by the National Enzyme Company, Forsyth, Mo. and republished by Omangod Press, Woodstock Valley, Conn. in 1980 under the title Food Enzymes for Health and Longevity), increasing numbers of health-conscious consumers in the organic foods movement have sought to follow an all raw food diet. In this book, Dr. Howell, through numerous references to research reports and studies conducted by himself and many others at hospitals, universities, and laboratories both here and abroad, attempts to prove the following points: (1) Every living organism is born with a limited store of enzyme energy, and, as this store of enzyme energy is exhausted, various kinds of degenerative diseases begin to overwhelm the organism. (2) Our digestive system was designed to utilize the enzymes present in raw food to begin the digestion of that food. (3) When raw food is heated to a temperature in excess of 118.degree. F.

(48.degree. C.), the enzymes present in that food begin to be destroyed. On page 72 of his book Enzyme Nutrition, The Food Enzyme Concept (Avery Publishing Group Inc., Wayne, N.J., 1985), Dr. Edward Howell writes of his work to determine the temperature at which enzymes are destroyed: "When I was in active medical practice, I developed a special electrothermotherapy immersion apparatus to apply high temperature treatment to specific parts of the body to stimulate local enzyme activity. This activity increases two to three times for every 10.degree. F. increase in local temperature. I modified some of this apparatus to permit experiments to determine the thermal death point of protoplasm (living matter), and found that immersion in water at 118.degree. F. (48.degree. C.) destroyed enzymes in a half-hour. The temperature of 118.degree. F. (48.degree. C.) also blistered the skin, and prevented subsequent germination of seeds when they were immersed for a half-hour." Subsequent research has shown that the destruction of many enzymes begins at a temperature of about 118.degree. F. (48.degree. C.), albeit at a slow rate. This destruction proceeds at an increasingly rapid rate as the temperature climbs past 118.degree. F. (48.degree. C.). And the longer that the enzymes are exposed to such elevated temperatures, the higher is the percentage of them that are destroyed. For example, the following table shows the activity of crystalline soybean beta-amylase enzyme after holding in a pH 5.5 acetate buffer for 30 minutes at various temperatures, and is fairly typical of the effects of heat on the activity of the enzymes in food. (J. Fukumoto and Y. Tsujisaka, Kagaku to Kogyo (Osaka) 28, 282 (1954); 29, 124 (1955).)

Brief Summary Text (8):
One of the important dietary staples in the diet of many health conscious consumers is bread and cracker-like products. Hitherto their choices in this category have been very limited: (1) The commercial semi-raw sprouted grain breads. These breads are customarily prepared without preservatives at temperatures ranging from 130-180.degree. F. (54-82.degree. C.) and, if not frozen, have a shelf life of less than three weeks in the refrigerator. Unfortunately with such a high preparation temperature (necessary to inhibit the bacterial and fungal growths which would result in an unacceptable product), it is doubtful if more than a small fraction of the enzymes retain activity in the final product. As will be demonstrated, both DV, the Percentage Destruction of Viability Due to Heat, and DG, the Percentage Decrease in Growth Potential Due to Heat, of such products exceeds 95%. Further, since these breads must be kept frozen during and after interstate shipment, they no longer contain appreciable amounts of Vitamin E, this vitamin being largely destroyed at freezing temperature. (Good Health with Vitamins and Minerals, John Gallagher, Summit Books, New York, N.Y., 1990, p. 70.) (2) Homemade raw sprouted grain bread. Many recipes are available to enable the health-conscious consumer to make these breads in his kitchen. The main disadvantages of such homemade raw breads is that they taste somewhat sour and bitter due to the hitherto excessive and unavoidable action of lactic acid bacteria during the preparation process. According to page 52 of the 4th edition of Food Microbiology (McGraw Hill Book Company, 1988) which is incorporated by reference, "The most important characteristic of the lactic acid bacteria is their ability to ferment sugars to lactic acid. This may be desirable in making products such as sauerkraut and cheese but undesirable in terms of spoilage of wines. Because they form acid rapidly and commonly in considerable amounts, they usually eliminate for the time being much of the competition from other microorganisms. The major genera include Leuconostoc, Lactobacillus, Streptococcus, and Pediococcus." In the discussion of these bacteria on pages 45-51 of Food Microbiology, the habitat of each of these genera is given:

Brief Summary Text (19):
To determine the properties of these millet crackers, Applicant slightly modified the above method to specify more precisely the amount of each ingredient used and the conditions of temperature and relative humidity maintained in order that this method can be repeated by researchers who wish to check Applicant's results: 1. Soak 3/4 cup (=4.9 ounces) of millet seed for 8 hours in distilled water. 2. Sprout millet for 48 hours. 3. Sprout (soak) 1/4 cup (=1.6 ounces) flaxseed in 3/4 cup (=6

ounces) lukewarm distilled water for 12 hours. Do not drain. Store in refrigerator until the millet has sprouted. 4. Grind together the sprouted millet seed and the soaked flax seed, adding only enough water to blend well. (The ground flaxseed acts as an agglutinant to hold these crackers together.) Add 1/2 teaspoon of salt (=0.07 ounces), and stir into the batter. 5. Remove 2 ounces of batter. Determine the pH value, pH.sub.o, of a 2:1 slurry of this batter by the method given in .sctn.3.1. Measure the water activity of this batter. 6. Add 4 teaspoons (=0.35 ounces) of poppy seeds, and mix well with the ground sprouts. (Please note that Baker's method only called for 2 teaspoons of poppy seeds.) 7. In a room with room temperature of 80.degree. F. and 50% relative humidity, pour out the batter in a thin layer on an oiled or flour dusted cookie pan and dehydrate. 8. Mark the batter into triangles when half dry. 9. After the batter has been dehydrated to a water activity of 0.45, break the batter into triangles, and measure the pH of a 2:1 slurry prepared from the batter by the method given in .sctn.3.1. This pH value is called pH.sub.f. Then .delta.pH.sub.LA =pH.sub.o -pH.sub.f.

Brief Summary Text (25):
To determine the properties of this pie crust, Applicant slightly modified the above method to specify more precisely the amount of each ingredient used and the conditions of temperature and relative humidity maintained in order that this method can be repeated by researchers who wish to check Applicant's results: (1) Sprout soft wheat berries for 3 days. (2) Dry the sprouts in a dehydrator at 125.degree. F. (52.degree. C.) (3) Reduce the relative humidity of the atmosphere in the Preparation Room (the closed room or area in which product preparation activities take place) to less than 50%. (4) Mill 1 cup of dried wheat sprouts (=5.0 ounces) to flour. (5) Blend 3 tablespoons (=0.6 ounces) of lecithin into 1/4 cup (=2 ounces) of apple juice, thus obtaining a mixture of lecithin and apple juice. (6) Thoroughly stir the milled wheat sprouts into the mixture of step 5. Continue to stir until a thick paste is formed. (7) Measure the water activity of this thick paste.

Brief Summary Text (27):
Since the methods to limit souring of this application are not used in the preceding method, the pie crust must be consumed immediately as any delay will allow bacteria to begin a souring, fermenting action in the pie crust. Also since the pie crust is not further dried in a dehydrator, it is soft and can not be used as a snack food. A pie crust should be crisp and dry. The pie crust made by the method given in Meyerowitz's Sprout Bread booklet is damp and does not hold together. Even after the above mentioned trial and error modifications, although the resultant pie crust held together, it was damp and gooey, and still would not appeal to many people. By the time either pie crust were shipped to market, they would be sour, bitter and possibly harmful to one's health. (Harmful microorganisms will make their appearance if water activity has not been reduced below 0.60 by about the 48th hour of drying.) Finally since the sprouts at step 2 above were dried at a temperature of 125.degree. F. (52.degree. C.), it is doubtful if more than a small fraction of the original enzymes are retained in the final product. As will be demonstrated, both DV, the Percentage Destruction of Viability Due to Heat, and DG, the Percentage Decrease in Growth Potential Due to Heat, of this product exceed 95%.

Brief Summary Text (30):
On the last page of the November 1989 issue of The Sprout House Newsletter (edited by Steve Meyerowitz), Mr. Meyerowitz makes the following comment about raw sprout bread: " . . . as a raw sprout, it should only be consumed in modest amounts because, again, it is only partially predigested . . . . It can take up to 24 hours to dry this `bread` and in that time, a slight souring may occur, giving it a sour-dough taste. The `modern` day sprout bread that we make . . . involves higher temperatures and an actual baking process takes place. This bread can be consumed in larger, dinner-size portions since the grain is cooked and digestion is easier."

Brief Summary Text (33):
There are two basic categories of shelf-stable ready-to-eat sprouted grain breakfast cereals: pasteurized and nonpasteurized. But the methods used during product preparation to prevent the bacterial souring and fungal growths which would otherwise ruin their taste (and appearance) and negatively impact their shelf-life differ greatly. In the first or pasteurized category, bacterial souring and fungal growths are prevented by using a sufficiently high temperature for a sufficiently long duration of time to destroy bacteria and fungi. In the second or nonpasteurized category, bacterial souring and fungal growths are prevented by reducing the water activity of the sprouts below the point at which any bacterial or fungal activity can occur.

Brief Summary Text (35):
Breakfast cereals in the first or pasteurized category are made by sprouting the grain, feeding the sprouted grain along with any other desired ingredients into a cooker extruder which mixes the ingredients into a uniform dough and subjects the mix to temperatures which increase from the input end of the extruder barrel, commencing at about 130.degree. F. (54.degree. C.) adjacent the input and increasing to about 300.degree. F. (149.degree. C.) at the output end of the barrel, where the resultant product is extruded and sliced into pellets. The pellets in turn are passed between flaking rollers which flake these pellets, thus producing breakfast flakes.

Brief Summary Text (36):
A big deficiency of these breakfast flakes is that they no longer contain an appreciable amount of enzymes due to the fact that they were heated to a temperature well above the temperature at which enzymes can survive for a sufficiently long duration of time to destroy the enzymes and damage or destroy other nutrients as well.

Brief Summary Text (38):
The method taught on page 25 of Steve Meyerowitz's booklet "Sprout Bread--A Complete Guide to Making Bread With Sprouts", produces the closest background art breakfast cereal to a second (nonpasteurized) category breakfast cereal. If a temperature of less than 118.degree. F. (48.degree. C.) had been specified, the breakfast cereal made by this method would have belonged to the second (nonpasteurized) category. But as it is taught, the method for making this cereal places it in the first (pasteurized) category of breakfast cereals given above. The method for making this breakfast cereal is as follows: 1. Sprout soft wheat grain for 3 or 4 days. 2. Dry the sprouts in a dehydrator at 125-145.degree. F. (52-63.degree. C.). 3. Using a small seed mill, grind the dried sprouts coarse, like grits.

Brief Summary Text (39):
The disadvantages of this breakfast cereal are as follows: 1. Using a temperature of 125.degree. F. (52.degree. C.) to dehydrate the sprouts for the 8-10 hours required to dry them will destroy most of their enzymes. 2. Grinding the dried sprouts even coarsely as taught above exposes most of the inner portion of the grain to the air causing the loss of some of the vital nutrients therein to oxidation. 3. There is a considerable buildup of heat as the dry sprouts are being ground, and, unless means are used to control this heat buildup, additional nutrients will be destroyed. 4. It is difficult to control the coarseness of the grind with a seed mill, and unless the sprouts are ground finely, there is the possibility that someone might chip a tooth on a hard dried sprout fragment. 5. Coarsely ground sprouts do not have the organoleptic properties of crispness and crunchiness that one usually associates with a cold breakfast cereal. People tend to prefer breakfast cereals that are crisp and crunchy.

Brief Summary Text (42):

All the products made by the above methods share the following disadvantages: (1) With the exception of the commercial sprout breads and sprouted grain breakfast cereals which have been cooked to prevent souring, they have a sour taste and are somewhat unpalatable. .delta.pH.sub.LA, the drop in the pH value of these products due to the formation of lactic acid in them during the preparation process is typically about 1.4. (2) Because of their extremely short shelf life, their commercial potential is limited. (3) The commercial products mentioned above are probably lacking significant enzyme activity due to the high processing temperature used and are deficient in vitamin E because they must be kept frozen. As will be demonstrated, both DV, the Percentage Destruction of Viability Due to Heat, and DG, the Percentage Decrease in Growth Potential Due to Heat, of such products are in excess of 95%. (4) Unless proper precautions are taken, pathogenic microbes may appear in these products. (The proper precautions to take are as follows: (a) Preventing the relative humidity of the atmosphere about the drying product from rising above 60%. (b) Maintaining a good circulation of drying air around the product as it dries. (c) Reducing the water activity of the product below 0.60 before about the 48th hour of drying has elapsed.) (5) Only modest amounts of truly raw sprouted seed products can be made due to the large drying surfaces required to make the wafer-thin crackers. If one tried to make inch thick crackers using only the methods of the background art, it would take over a week for the cracker batter to dry, and the batter would be quite moldy long before then. Hitherto, there has been no way to avoid this.

Brief Summary Text (44):
U.S. Pat. No. 4,859,486 to Douglass (1989) teaches a method for preparing an uncooked sunflower seed foodstuff from sprouted sunflower seeds. Bacterial souring is limited to a small extent by utilizing a dehydration temperature of 110.degree. F. (43.degree. C.) to dehydrate the still moist sunflower seed sprouts after they were ground and formed into a very thin dough. Due to the thinness of the batter (which limits souring to some extent), large drying surfaces are required, and only small amounts can be made. (The larger the drying surfaces required, the more work it is to form the wafers, and place them on the drying surfaces, and the more work it is to keep the drying surfaces clean.) The average thickness of the final product is about 1/8 inch.

Brief Summary Text (52):
To overcome the disadvantages of the background art products described in the previous section, I present as my invention NonPasteurized, Controlled Lactic Acid Souring Sprouted Food Products, hereinafter referred to as "NP CLASS" Food Products. NP CLASS Food Products has two species. The first species is referred to as NP CLASS Crackers. These crackers are prepared with methods to inhibit mold and limit bacterial souring, thus permitting these crackers to be prepared at a temperature low enough to minimize damage to vital nutrients (especially enzymes) thus producing tasty food products with many health benefits. The second species is referred to as Raw Unsoured Shelf-stable Testae Intact Converted Sprouted Seed Products, hereinafter referred to as "RUSTIC Sprouted Seed Products". Also presented is the RUSTIC Press, a special device used to produce an exceptionally thin compressed sprouted seed product. RUSTIC Sprouted Seed Products are prepared without cooking or preservatives from seeds utilizing sprouting techniques and low temperature water activity reduction methods to prevent bacterial souring and fungal growths thus minimizing damage to vital nutrients (especially enzymes) and thus producing tasty shelf-stable food products with many health benefits.

Brief Summary Text (61):
Both subspecies of NP CLASS Crackers share the following characteristics: No discernible mold or fungal growths. This is the sine qua non of cracker manufacturing, for moldy crackers have no commercial value regardless of their other properties, no matter how beneficial they may be. By limiting the relative humidity of the atmosphere about the cracker batter to less than 45% while dehydrating the cracker batter, maintaining good air circulation at the surface of

the drying batter, and reducing the water activity of the cracker batter below 0.60 before about 48 hours have elapsed, it is virtually assured that there will be no mold or fungal growths on the final product. Nonpasteurized. This characteristic is the main attraction for the raw health food enthusiast. Because these products have been prepared at a temperature well below the temperature at which food enzymes are destroyed, NP CLASS Crackers contain most, if not all, of the enzymatic activity of the living sprouts from which they were made. As will be disclosed, laboratory analyses show that NP CLASS Crackers retain more than 90% of the diastatic activity of the sprouts from which they were made. Contain minimal or no lactic acid. As was mentioned earlier, raw sprouted grain crackers which are more than about 1/8 inch thick prepared by the methods of the background art develop a considerable amount of lactic acid which causes the resultant product to taste unacceptably sour and bitter. Using the methods disclosed herein to make NP CLASS Crackers, .delta.pH.sub.LA, the pH drop due to lactic acid formation during the dehydration of the cracker batter is less than 1.15 for crackers up to an inch thick, as compared with a .delta.pH.sub.LA of 1.3 or greater during the preparation of background art products which are more than 1/8 inch thick. The small amount of lactic acid souring which causes a pH drop of no larger than about 1.15 in the cheesy varieties of NP CLASS Crackers imparts a pleasant cheesy taste to the crackers. When the drop in pH due to lactic acid formation is greater than about 1.3, the cracker develops a sour and bitter taste which renders it virtually unmarketable. Water Activity of less than 0.50. Due to its low water activity this product is shelf-stable, and will keep for many months without noticeable deterioration. No pH gradient from the lower to the upper surface of the cracker. All background art products are prepared upon a solid drying surface which leads the upper surface of the drying batter to dry more quickly than the lower surface which is not exposed to drying air. Consequently there will be considerable formation of lactic acid along the lower surface of the batter and gradually diminishing amounts of lactic acid formation in those regions of the batter which are successively closer to the upper surface of the batter. This pH gradient is one of the reasons why background art products have an unacceptable sourness and bitterness. NP CLASS Crackers, on the other hand, are prepared on dehydrator screens. Therefore, both the upper and lower surfaces of the spread batter dry simultaneously, and there is no pH gradient from the lower to the upper batter surfaces. (Suitable screen material would have a hole size of about 0.12 inches by 0.14 inches, and a strand thickness of about 0.05 inches. The screen material provides a perforated surface which gives drying air access to the lower drying surface of the cracker batter.) The type of drying surface provided by a supported screen, mesh, perforated surface or other functionally equivalent surface which gives drying air access to both the upper and lower surfaces of the drying batter simultaneously shall be called a "double-access drying surface". The upper surface of the double-access drying surface which contacts the lower surface of the drying batter shall be referred to as "the upper surface of the double-access drying surface". NP CLASS Crackers can be made considerably thicker (up to 1 inch or more) than background art products which results in a larger cracker yield from a given drying surface. The result is reduced preparation time (with concomitant reduced energy cost), reduced materials cost (not as many drying surfaces required), and reduced clean-up time, there not being as many drying surfaces to clean. Substantially uniform appearance of the upper and lower surfaces of the cracker. When the cracker batter is dried on screens rather than on solid drying surfaces, drying air has access to both upper and lower batter surfaces, leading to a substantially uniform appearance for both surfaces. When a solid drying surface is used, the lower drying surface develops a much lighter color and smoother appearance than the upper drying surface. Moderating the hardness of the cracker. NP CLASS Crackers consisting of equal amounts of sprouted wheat and pieces of absorbent vegetal matter are almost too hard for human consumption due to the high gluten content of wheat. The hardness of the cracker can be moderated either by using a considerably larger proportion of absorbent vegetal matter or by incorporating a sufficient percentage of nongluten-containing sprouts in the cracker batter. (When a cracker batter containing only sprouted wheat is fully

dehydrated, the resultant product is hard enough to scratch soft wood and break a tooth of one who attempts to consume it.) Due to its high oil content, the preferred absorbent vegetal matter for moderating hardness is cured olives. Even when the last trace of moisture is removed from cured olives via dehydration, the dried olives are still quite soft and flexible due to their high oil content. Additionally either subspecies may be prepared with an added amount of a water activity depressant. A water activity depressant is any edible substance which can be added to the cracker batter to lower its water activity. If a sufficient amount of water activity depressant is added to the cracker batter to lower its water activity below 0.91, the growth of souring microorganisms is suppressed, thus inhibiting lactic acid formation during the preparation of the product. (When using salt as the water activity depressant, however, enough salt must be added to the cracker batter to lower its water activity below 0.75--halophilic ("salt tolerant") bacteria thrive in environments with water activities all the way down to 0.75.)

Brief Summary Text (74):
Methods for Reducing Lactic Acid Formation in Raw Sprouted Seed Products: (1) Maintaining the relative humidity of the atmosphere about the drying batter below 45%, and preferably even lower. The lower the relative humidity of the atmosphere about the drying batter, the quicker will dehydration of the batter proceed, thus giving the lactic acid bacteria in the batter a much shorter time in which to produce lactic acid before the water activity of the drying batter drops below 0.91. (0.91 is the minimum water activity level required to support bacterial growth. However, if salt is the water activity depressant, halophilic bacteria can thrive at water activities all the way down to 0.75.) Further, the relative humidity of the atmosphere about the drying batter must be prevented from rising above 100% times the desired water activity of the final product. For example, if the desired water activity of the product is 0.35, the relative humidity of the atmosphere about the drying batter should be maintained below 35%. Keeping the relative humidity below 45% greatly reduces drying time, thus reducing bacterial souring, and preventing mold. If, at any time, the relative humidity is allowed to climb above 70%, molding is encouraged. This method is absolutely essential to product success. Without this method, product success is unlikely regardless of what other methods are used. It is preferred that the operations of dehydrating the sprouts, preparing the cracker batter, and dehydrating the cracker batter be performed in a closed room or area in order that the temperature and relative humidity of the atmosphere about the drying products can be carefully controlled. Throughout this specification, the term "Preparation Room" will be used to refer to the closed room or area in which product preparation activities which involve dehydration take place. It is preferred that the temperature in the Preparation Room be maintained in the range of 90.degree. to 104.degree. F., and that the relative humidity of the air (atmosphere) in the Preparation Room be maintained below 45%. According to pages 5 and 124 of the fourth edition of Food Microbiology: "Microorganisms have an absolute demand for water, for without water no growth can occur. As might be expected, the exact amount of water needed for growth of microorganisms varies. This water requirement is best expressed in terms of available water or water activity a.sub.w, the vapor pressure of the solution (of solutes in water in most foods) divided by the vapor pressure of the solvent (usually water). The a.sub.w for pure water would be 1.00, and for a 1.0 m solution of the ideal solute the a.sub.w would be 0.9823. The a.sub.w (.times.100) would be in equilibrium with the relative humidity (RH) of the atmosphere about the food. In other words, a.sub.w.times.100=equilibrium relative humidity (ERH) (%), or (ERH.div.100)=a.sub.w. A relative humidity about a food corresponding to an a.sub.w lower than that of the food would tend to dry the surface of the food; conversely, if the relative humidity were higher than that corresponding to the a.sub.w, the latter would be increased at the surface of the food." "Too high a relative humidity favors the growth of spoilage micro-organisms. The highest humidity, near saturation, is required for most bacterial growth on the surface of foods; less moisture is needed by yeasts, about 90 to 92 percent, and still less by molds, which can grow in a relative humidity of 85 to 90 percent." (2) Mixing the product

batter with pieces of absorbent vegetal matter equal to at least P.sub.avm percent of the weight of the final dehydrated product. The absorbent vegetal matter is selected from the group consisting of dried fruit, dried vegetables and soft seeds. If soft seeds are used, it is preferable that these seeds be pre-soaked but not sprouted and then dried. (Soaking the seeds for twelve hours deactivates the majority of the enzyme inhibitors in the seeds. It has been found, however, that the negative effect of the enzyme inhibitors in raw unsprouted seeds is more than overcome if an equal amount of raw sprouted seeds is eaten at the same time.) The following mild-tasting, soft seeds have been found to result in an acceptable product: whole hulled sesame seeds, whole poppy seeds, hulled sunflower seeds, unhulled teff grain (which, although not really soft, is very small (1/150th the size of a wheat grain), and thus presents no difficulty to mastication) and steel cut oats (the oats are fractured for easier mastication). Although not tried, whole unhulled sesame seeds should also yield an acceptable product. Each of these seeds is relatively soft (or, in the case of teff seeds, very small) when compared to such hard seeds as wheat, triticale, rye, barley, and rice. Further each of these seeds has a relatively mild taste when compared with such strong tasting soft seeds as caraway, dill, anise, cumin, coriander, and celery. (Small amounts of these stronger tasting seeds can be added for flavor, and then they serve a double function in the batter.) Using seeds which are soft (or very small) greatly facilitates mastication of the resultant product. For reasons of taste, softness, availability, and cost, the preferred soft seeds are whole hulled sesame seeds (with whole poppy seeds running a distant second). Adding pieces of absorbent vegetal matter to the product batter gives rise to four unexpected results: 1. If a sufficient amount of absorbent vegetal matter is added to the product batter, the batter becomes thick enough (due to the absorption of the liquid of the mixture by the dry pieces of absorbent vegetal matter) to be spread upon dehydrator screens instead of solid sheets without significant leakage through the screen apertures. The inventive trick here is to add all the ingredients except the pieces of absorbent vegetal matter to the batter, and stir the batter well. The batter is still easy to stir and the ingredients of the batter can be thoroughly mixed together. Then after the batter is thoroughly mixed, the pieces of absorbent vegetal matter are stirred in last. The amount of water in the batter and the amount of pieces of absorbent vegetal matter now being added can be so proportioned that a very thick batter is formed which can now be poured on dehydrator screens without significant leakage through the screen openings. However, this mixture is very difficult to stir and, unless stirred well, the pieces of absorbent vegetal matter will not be evenly dispersed or distributed throughout the batter. The batter, being very stiff, is also difficult to spread evenly on the screens, and some of the batter will be forced into the screen openings making the dehydrated product somewhat difficult to remove from the screens. At the expense of a slight increase in bacterial souring, somewhat more water can be added to the batter, such that the mixture is easier to stir and the pieces of absorbent vegetal matter can be more easily and evenly dispersed throughout the batter. Then, following preparation of the batter, the batter can be allowed to set for about 30 minutes or so, during which time, the pieces. of absorbent vegetal matter therein will absorb sufficient water from the rest of the batter to make it thick enough so that it can now be spread on dehydrator screens without significant leakage through the screen openings. But now, again, the batter being very stiff is difficult to spread evenly on the dehydrator screens, and some batter will again be forced into the screen openings making the dehydrated product somewhat difficult to remove from the screens. Therefore, the most preferable way to prepare and spread the batter is as follows: After having prepared the batter with somewhat more water as just described, spread the batter on a flat surface in portions just smaller than the screens on which the batter will later be placed. Since somewhat more water was used, the batter is fairly easy to so spread. Now the spread batter portions can be allowed to set for about 30 minutes or so as above, during which time the pieces of absorbent vegetal matter in the batter absorb liquid from the batter thus making it thicker. After this time, the batter should be sturdy enough to be sliced and lifted off the flat surface and placed on dehydrator screens without breaking apart

or leaking through the screens. Since no pressure need be applied to place these batter portions on the dehydrator screens, little, if any, of the batter will seep through the screen openings, and, at the end of the dehydration process, the dried batter can be easily removed from the screens. After the batter portions have been placed upon screens, the batter or mixture on each screen is dehydrated until the water activity thereof has been reduced below 0.60. The use of double-access drying surfaces such as dehydrator screens instead of solid sheets allows the drying air of a dehydrator to dry both the upper and lower surfaces of the drying batter simultaneously. This speeds up drying time and greatly reduces bacterial souring. 2. The second unexpected result is that the addition of pieces of absorbent vegetal matter to the batter results in a less soured product. Without wishing to be bound by theory, it is believed that the addition of pieces of absorbent vegetal matter to the batter results in a less soured product because the pieces of absorbent vegetal matter absorb some of the water from the batter during the early hours of dehydration, thus making it unavailable for microbial growth. It should be mentioned here that if the pieces of absorbent vegetal matter are soft seeds, sprouting and dehydrating the seeds instead of merely soaking and dehydrating the seeds, causes the seeds to lose most of their water absorbing ability, making them virtually useless for their intended purpose in this invention. (By sprouting, it is meant that after the seeds have been soaked, they are exposed to the air for more than about four hours, toward the end of which time a small shoot appears.) 3. In the case where the pieces of absorbent vegetal matter are soft seeds, it has been found that even after the soft seeds are dehydrated, they are still soft, and make the resultant cracker somewhat softer and easier to chew. Thicker crackers can now be made. Crackers made of sprouted wheat alone, for example, have very sharp edges when they are thoroughly dried. 4. In the case where the pieces of absorbent vegetal matter are shredded dried cured olives, the resultant cracker is chewy and moist due to the high oil content of dried olives. Many taste-conscious people consider that NP CLASS Crackers prepared without either dried shredded cured olives or a syrupy type of water activity depressant (see 3A below) are too dry to be palatable. (3A) For the Sprout Flour Based Crackers, adding a water activity depressant to the liquid into which the milled dried sprouts are to be stirred. The following table from page 10 of the fourth edition of Food Microbiology by Frazier and Westhoff (McGraw-Hill Book Company, 1988) shows the lowest water activity values permitting growth of spoilage organisms:

Brief Summary Text (82):
NP CLASS Crackers are uncooked; i.e. they are not subjected to such times and temperatures which would denature the proteins thereof. Further, these products are nonpasteurized. According to the fourth edition of Food Microbiology, "Pasteurization is a heat treatment that kills part but not all of the microorganisms present and usually involves the application of temperatures below 100 C. . . . Times and temperatures used in the pasteurizing process depend on the method employed and the product treated. The high-temperature-short-time (HTST) method employs a comparatively high temperature for a short time, whereas the low-temperature-long-time, or holding (LTH), method uses a lower temperature for a longer time. Some examples follow of pasteurizing treatments given various types of foods. The minimal heat treatment of market milk is at 62.8 C for 30 minutes in the holding method; at 71.7 C for at least 15 seconds in the HTST method; and at 137.8 C for at least 2 seconds in the ultrapasteurized method. . . . Dried fruits usually are pasteurized in the package at 65.6 to 85 C for 30 to 90 minutes, the treatment varying with the kind of fruit and the size of the package." (pages 24-25) All of these pasteurization methods destroy most of a food's enzyme activity. In fact, according to page 98 of the fourth edition of Food Microbiology, bovine phosphatase enzyme is monitored in the pasteurization of milk. Detection of this enzyme in processed milk indicates that the milk was not properly pasteurized. What is meant, therefore, when it is stated that the NP CLASS Crackers are nonpasteurized, is that they were not subjected to such temperatures and durations of time which would be required to destroy most of the bacterial and fungal activity which ordinarily takes place in sprouts when their seed coats are broken. Such temperatures and

times also destroy most of the enzyme activity as well. Further, NP CLASS Crackers are never heated to a temperature higher than 104.degree. F. (40.degree. C.), a temperature well below that required to destroy any of the known nutrients in seed sprouts.

Brief Summary Text (100):
As will be seen, the essence of this invention is that the souring of the processed sprouts which would otherwise ruin the taste of NP CLASS Crackers is limited by low temperature methods (which spare enzymes) rather than by cooking (which destroys enzymes) or by chemical preservatives (which may be harmful). While souring is being suppressed, water activity reduction methods are quickly reducing the water activity of these products below the level required to support microbial growth.

Brief Summary Text (103):
Therefore the methods used in making NP CLASS Crackers limit bacterial growth until the water activity of the product is reduced below 0.60. (Freeze drying can not be used because freezing foods destroys most of their vitamin E, vitamin E being the only vitamin damaged by freezing temperature.)

Brief Summary Text (121):
A second test of whether NP CLASS Crackers still possess their "vitality" is the sprouting test. If unsprouted seeds of the type used in these products can be subjected to the same temperatures and durations of time as NP CLASS Crackers and will still sprout, it can be said that the temperatures and durations of time of the methodology herein disclosed have done nothing to harm the "vitality" of the sprouts in NP CLASS Crackers. A method for verifying that 104.degree. F. (40.degree. C.) is a "safe" temperature for the vitality of NP CLASS Crackers whereas 125.degree. F. (52.degree. C.) is a "destructive" temperature for this vitality is taught in the "Verification of Product Vitality" Section (.sctn.5.7) of this patent application. An actual example is also shown.

Brief Summary Text (124):
Accordingly, several objects and advantages of NP CLASS Crackers are: (a) to provide healthful alternatives to baked goods and commercial snack foods retaining the vital nutrients (enzymes, proteins, vitamins, minerals, etc.) of the sprouts from which they were made in as natural a state as possible; i.e., the heat labile nutrients in these products have not been damaged. (both species) (b) to provide an easy to chew raw sprouted food product with pleasant taste and excellent shelf life (the souring action which would render the product somewhat unpalatable being limited) and thus suitable for a dietary staple and a healthful snack food. Samples of my product (in which a water activity depressant was used) had no discernible mold or rancidity and had excellent taste even after 3 months in the refrigerator. This long and stable shelf life is due to the water activity of the product having been reduced to less than 0.60. (both species) (c) to provide a raw sprouted food product which, although prepared without cooking or chemical preservatives, resists mold, fermentation, fungal growths, and vitamin depletion. (both species) (d) to provide a method of producing raw sprouted food products in which the sprouting process can be separated in time from the water activity reduction process which produces the final product. In the method of the Sprout Flour Based Species, the seeds are sprouted and then dried. These dried sprouts will keep for months in the refrigerator since their outer coats are intact and their water activity is less than 0.60. Then, at any time when one is ready to produce the final product, the dried sprouts can be taken from the refrigerator, milled with a flour mill, rehydrated with or without a water activity depressant, and then subjected to water activity reduction to produce the final product. (Sprout Flour Based NP CLASS Crackers) (e) to provide a quick drying method of making large quantities of good tasting sprouted products very economically and with significant energy savings. With each species, the batter not only can be made up to 1 inch thick, but also can be spread on dehydrator screens instead of dehydrator solid sheets thus greatly speeding up the dehydration process and reducing bacterial souring. Not only can

larger batches of crackers now be obtained, but also fewer dehydrator trays and screens need be used, and considerably less cleanup is required. At last large scale economical production of NP CLASS Crackers is feasible. (both species) (f) to provide a dietary staple prepared well below 160.degree. F. (71.degree. C.), the temperature at which proteins are denatured and possibly become carcinogenic. (Some commercial baked goods are prepared at temperatures of more than three times the temperature at which proteins are denatured. This is of great concern to me, for such high cooking temperatures are a possible contributing factor to our country's current cancer epidemic. For example U.S. Pat. No. 5,000,968 to Szwerc et al. (1991) discloses crackers prepared at temperatures ranging from 350.degree. F. to 600.degree. F., and U.S. Pat. No. 3,911,142 to Huelskamp et al. (1975) discloses a protein snack food dehydrated at temperatures ranging from 600.degree. F. to 700.degree. F.) (g) to provide a good tasting raw sprouted seed product with severely limited souring. The souring which would have occurred is virtually suppressed by the use of sufficient water activity depressant. (both species) (h) to provide methods of preparing raw sprouted seed products in which mold and fungal growths are entirely prevented. (both species) (i) to provide methods of preparing raw sprouted seed products which succeed in preserving more than 90% of the diastatic activity of the sprouts from which they were made. (both species) (j) to provide a raw sprouted food product which need not be frozen which would destroy its vitamin E content. (both species) (k) to provide a product, which, even when thoroughly dry, will not cut up the inside of one's mouth with sharp edges as is the case with sprouted grain products which lack sufficient amounts of nongluten-containing seeds to moderate hardness. Since these products are tasty and easily chewed, they will appeal even to those who do not normally consume health foods. (both species) (l) to provide a high fiber dietary staple with a greatly improved amino acid profile over similar unsprouted products. (both species) (m) to provide a healthful product with not only a pleasant satisfying taste but also an attractive appearance as well. (both species) (n) to provide a dietary staple and snack food with the taste of Essene raw sprouted bread, the enzymes and other nutrients of the raw sprouted seeds, and long shelf life. (Liquefied Sprouts Based NP CLASS Crackers) (o) to provide convenient raw snack foods made from sprouted seeds suitable for those who have embarked on a raw food diet. Those who go on a raw food diet sometimes have difficulty obtaining adequate amounts of high quality protein--these products go a long way toward meeting that need. (p) to provide a shelf-stable nutritious food which could be used to alleviate world hunger. Many health experts now agree that most baked breads can no longer be considered the staff of life. The tasty and nutritious products of this invention go a long way to restoring life (i.e., enzymes) to the staff of life. (both species)

Brief Summary Text (126):
RUSTIC Sprouted Seed Products are prepared without cooking or preservatives from seeds utilizing sprouting techniques and low temperature water activity reduction methods to prevent bacterial souring and fungal growths thus minimizing damage to vital nutrients (especially enzymes) and thus producing tasty shelf-stable food products with many health benefits. The seeds are converted to a form suitable for human consumption by various methods which are very briefly summarized below: sprouting, compressing, refrigerating, and dehydrating the seeds. sprouting, dehydrating, compressing, and further dehydrating the seeds. soaking seeds for several days, compressing them in the RUSTIC Press, and then dehydrating them. soaking seeds for several days, freezing the seeds, and then dehydrating the seeds.

Brief Summary Text (129):
The various species of RUSTIC Sprouted Seed Products share the following characteristics: Raw: The seed sprouts in these food products are raw, not having been subjected to such temperatures and durations of time which would destroy the enzymes therein. Unsoured: The drop in pH value of these food products during product preparation due to lactic acid bacterial souring is less than 0.1. Hence, these products have a pleasant taste. Shelf-stable: The water activity of these

food products is less than 0.60. Products with a water activity below 0.60 will not support the growth of any known micro-organism. Hence, these food products are shelf-stable. Testae Intact: The compressed seed sprouts in these food products have substantially unfractured testae (seed coats) and are of substantially uniform thickness and consistency throughout. The methods outlined below ensure that although the compressed seeds in these food products have had their testae (seed coats) sufficiently fractured to facilitate easy mastication, the testae are still sufficiently intact to substantially shield the delicate nutrients within the seeds from the destructive effects of oxidation. These methods aim to ensure that the amount of fracturing of the seed coats is no more than the minimum required to ensure comfortable mastication of the seeds of the food product. Thus the compressed seed sprouts in these food products have minimally fractured testae (seed coats) and are of substantially uniform thickness and consistency throughout. Consequently the vital nutrients therein are afforded a protection not available in conventionally produced products. (It should be mentioned, however, that the more the seed sprouts are compressed, the greater the degree of fracturing of the testae. The methods of this invention ensure that for any degree of compression of the sprouted seed, fracturing of the testae and formation of sprout flour as a result of this compression are minimized.) It should be noted, however, that seeds which do not have their seed coats broken to some extent are not contemplated by this invention. Hence, both the methods of NP CLASS Crackers and RUSTIC Sprouted Seed Products contemplate the processing of broken cell wall sprouts. Converted: Since the seed sprouts in these products are converted to a form which crumbles under moderate pressure, these products are very easily masticated. Sprouted: This patent application teaches three methods of sprouting the seed, one of which is known and the other two of which are new.

Brief Summary Text (134):
The low temperature water activity reduction methods utilized to prevent bacterial souring and fungal growth are as follows: 1. The Compression and Refrigeration Method. This method can be used to produce dried compressed sprouts. In this method, sprouts are compressed with a roller mill and dried in a frost-free refrigerator until their water activity has fallen below 0.70. A dehydrator is then used to further reduce the water activity of the sprouts below 0.60 which is a level of water activity below the minimum moisture requirement of any known micro-organism. If it is then desired to make flavored compressed sprouts or compressed sprout cake, the dried compressed sprouts are treated with flavoring or an agglutinant respectively, dried in a frost-free refrigerator until their water activity has again fallen below 0.70, and then further dried with a dehydrator until their water activity has fallen below 0.60. Products with a water activity below 0.60 will not support the growth of any known micro-organism. 2. The Dehydration and Compression Method. This is a second method for producing dried compressed sprouts. In this method, the sprouts are dehydrated until their water activity has fallen below 0.91, compressed with a roller mill, and then further dehydrated until their water activity has fallen below 0.60, which, again, is below the minimum moisture requirement of any known micro-organism. 3. The Ultrathin Compression and Dehydration Method. This third method for producing dried compressed sprouts yields very thin sprouts which, consequently, dry very quickly. In this method, wet soft sprouts are compressed between two suitably sized hard flat surfaces, held in a compressed state for sufficient time for the sprouts to retain their flattened form, and then dehydrated until their water activity has fallen below 0.60. Since the compressed sprouts produced by this method are very thin and dry quickly, their water activity drops so quickly below 0.60 that bacterial souring is minimal. Any press such as the RUSTIC Press disclosed herein which has the proper characteristics to compress wet soft sprouts very thin will be referred to as a Wet Grain Press.

Brief Summary Text (135):
RUSTIC Sprouted Seed Products are uncooked; i.e. they have not been subjected to such temperatures and times which would denature the proteins thereof. Further,

these products are nonpasteurized.

Brief Summary Text (136):
What I mean when I say that my products are nonpasteurized, is that they were not subjected to such temperatures and durations of time which would destroy most of the bacterial and fungal activity which ordinarily takes place in seed sprouts when they are compressed. Such temperatures and durations of time also destroy most of the enzyme activity as well. Further, the highest temperature these products are subjected to is 104.degree. F. (40.degree. C.), a temperature well below that required to destroy any of the known nutrients in seed sprouts. By "compression", I mean any process which will reduce the thickness of seed sprouts sufficiently so that human beings can masticate them without difficulty. The amount of compression required depends on the hardness, moisture content, and size of the seed sprouts and is different for each variety of seed. As used herein, compression is the flattening of sprouts by such means as a roller mill or a Wet Grain Press. Unless such sprouts as wheat, rice, triticale, and barley are further processed by compression or milling, they are very difficult for human beings to chew.

Brief Summary Text (138):
The important thing about the seeds in the products of this invention is that they have had their enzyme content augmented by having been soaked in water. (This soaking in water actually begins the sprouting process. It must be said that the mere act of soaking the seed is the actual beginning of the sprouting process. The seed is no longer dormant. Before being soaked in water, the seed merely had a "life potential"; during the soaking phase of sprouting, it actually comes to life as is evidenced by the dramatic increase in enzymatic activity and the corresponding decrease in harmful enzyme inhibitors.) The seed may then be drained and then rinsed every few hours or so to further increase its enzyme content. Or it may enter into further processing without experiencing the rinsings phase at all. In that event the increase in enzymatic content is small. If the next processing step for the seed were compression followed by dehydration or refrigeration, the resultant increase in enzymatic activity over the unsprouted state would be less than 25 percent. If the next processing step for the seed were dehydration at a temperature of 104.degree. F., for example, during the first three hours of dehydration the seed would still have sufficient moisture to continue sprouting (thus experiencing the initial airing phase) and the resultant increase in enzymatic activity over the unsprouted state would be about 50 percent.

Brief Summary Text (159):
As will be seen, the essence of RUSTIC Sprouted Seed Products is that low temperature water activity reduction methods (which spare enzymes) rather than cooking (which destroys enzymes) or the use of preservatives (which also spares enzymes but which many find objectionable) are used to inhibit bacterial souring. Lactic acid bacteria are normally present on the surface of seed. When the seed is compressed, portions of the seed coat (testa) are broken, and the lactic acid bacteria enter. If there is sufficient warmth and moisture, these bacteria grow and begin fermenting the sugars of the seed to lactic acid thus ruining the taste. The low temperature water activity reduction methods of this invention prevent this bacterial souring. When the compressed sprouts are further treated with flavoring or agglutinant prior to making flavored compressed sprouts or compressed sprout cakes respectively, the high water content of the flavoring or agglutinant will again provide the moisture necessary for bacterial souring and fungal growth to occur unless low temperature water activity reduction methods are again used to prevent this. (In this context, an agglutinant is an edible substance which will cause the discrete compressed sprouted seeds of my products to adhere to one another.

Brief Summary Text (165):
A second test of whether the products of my invention still possess their "vitality" is the sprouting test. If unsprouted seeds of the type of seed used in

my products can be subjected to the same temperatures for the same durations of time as the products of my invention and will still sprout, it can be said that the temperatures and times of the methodology I am teaching have done nothing to harm the "vitality" of the sprouts in my products. A method for verifying that 104.degree. F. (40.degree. C.) is a "safe" temperature for the vitality of the products of my invention whereas 125.degree. F. (52.degree. C.) is a "destructive" temperature for this vitality is taught in the .sctn.5.7.2, "Verification of Product Vitality for RUSTIC Sprouted Grain Products". An actual example is also shown.

Brief Summary Text (166):
Accordingly, the objects and advantages of the present invention are: (a) to provide a healthful breakfast cereal and a granola-like bar made therefrom which contain raw sprouted seeds. Sprouting seeds for 18 hours increases their amylase enzymatic activity 50 fold with a corresponding decrease in enzyme inhibitors. (When the Quick Sprouting Method is used, the seeds sprout for only about 3 hours which leads to only a 50 percent increase in amylase enzymatic activity, with a corresponding 50 percent decrease in enzyme inhibitors. When the Long Soak Sprouting Method is used, the seeds have only been exposed for a total of about fifteen minutes to the air--during the twelve hour rinsings--and have just barely started sprouting having only very tiny shoots.) During the sprouting process, the starches of the seeds are converted to sugars. And since microbial activity is suppressed during product preparation, these products retain their naturally sweet taste. (b) to provide healthful raw sprouted seed breakfast cereals and products based thereon which have not been exposed to such temperatures and durations of time which would destroy the enzymes and other vital nutrients thereof. (all species) (c) to provide healthful raw sprouted seed breakfast cereals and products based thereon which are not prepared with preservatives which many health knowledgeable people are attempting to avoid. (all species) (d) to provide healthful raw alternatives to baked goods and commercially available snack foods prepared without preservatives or nutrient-destroying heat or cold, thus retaining the vital nutrients (enzymes, proteins, vitamins, minerals, etc.) of the sprouts from which they were made in as natural a state as possible. (species 3) (e) to provide raw sprouted seed products which have as little as possible of the interior portion of the seed exposed to the ravages of oxidation during processing, thus better retaining those vital nutrients which are especially vulnerable to oxidation. (Flour based and cooker extruder produced sprouted seed products have had the entire inner portion of the seed exposed to the air during processing.) (all species) (f) to provide raw sprouted seed products in which the compressed sprouted seeds of the product have been compressed to less than their MMT, and, therefore, have an MD of less than 1. Consequently, the product is very easily masticated. One should not have to worry about chipping a tooth while eating. (species 1-3) (g) to provide unsoured raw sprouted seed products which are shelf-stable. Since these products are unsoured, they have a pleasant taste, which will encourage even the most taste-conscious consumers to use these products. And since the water activity of these food products is less than 0.60, they are not susceptible to microbial activity as long as they are kept dry. (all species) (h) to provide raw sprouted seed products in which the sprouting process has been severely truncated in order to provide a lower priced product with an even more acceptable taste for the mass market. (i) To provide raw sprouted seed products in which fracturing of the seed coats of the compressed seed sprouts has been minimized. Therefore these products are substantially free from sprout flour which would render the products unmarketable. (all species) (j) To provide ultra-thin sprouted seed flakes which have the consistency, tenderness, and mouth-feel of commercially available grain-flakes. Being very thin and tender, these sprouted seed flakes do not need to be soaked in liquid prior to consumption by the consumer. (k) To provide a dried sprouted seed food with the consistency and organoleptic properties of puffed wheat. Being very tender, this product does not need to be compressed before consumption by humans. (species 4) (l) to provide a device for compressing wet sprouts with the following advantages over a roller

mill: (1) much easier to use in continuous operation, for much easier to keep from clogging up with crushed sprouts. (2) more easily cleaned at end of compressing operation. (3) can be used to exert a pressure for a given period of time. (4) much cheaper to manufacture and service. (5) much easier to vary the amount by which the sprouts are compressed.

Brief Summary Text (167):
Having read this far, the reader might think that the idea of using low temperature water activity reduction methods to produce a breakfast cereal is such a simple one that surely it must have been done before. One might therefore think that preparing a breakfast cereal by these methods is obvious to one with ordinary skill in the art. This is not true. A careful review of the literature in the art of sprouting shows that other than making sprout bread, sprout flour and such products as barley malt, those who are skilled in this art ordinarily do not dehydrate the sprouts they grow, preferring to eat and market fresh sprouts. And, none of the books or articles with which I am familiar in the field of nutrition teaches a method for making raw breakfast cereals using a roller mill. It certainly was not obvious to me how best to use a roller mill to make compressed sprouts. In my first few attempts to make compressed sprouts, I tried feeding freshly grown 24 hour sprouts into the hopper of a roller mill, and turning the crank. My progress in rolling the wet sprouts was somewhat slow, and the moist compressed sprouts gummed up the rollers of the roller mill, making cleanup difficult. It should be noted, however, that the advertisement for this Rolled Oats Crusher roller mill in the Walnut Acres catalog does not even hint that this roller mill might be suitable for preparing a raw breakfast cereal. The advertisement reads in part as follows: "Make your own hot cereal from freshly rolled grains . . . Our Rolled Oats Crusher flakes oats, rye, wheat, barley and other `soft` grains, ready to cook up into a cereal or for your recipes . . . "

Brief Summary Text (168):
Thus, while it was known that flaked or rolled grains make an excellent hot cereal, what was not known, and what I believe I am the first to discover is that when low temperature water activity reduction methods are used to produce compressed sprouted grain products, the compressed dried sprouts therein are very easy to chew and consequently make very delicious as well as nutritious raw breakfast cereals and other products based thereon. Then also, since most people do not appreciate the fact that cooking destroys vital enzymes, they would not have had an incentive to look for ways to prepare raw as opposed to cooked breakfast cereals. The vast majority of the human race have always consumed their grains cooked, and most people believe that grains require cooking to make them edible. Further, those with experience in the art of using a roller mill to crimp (roll) grain customarily do so to prepare grain for consumption by livestock and ordinarily have neither experience in the art of sprouting nor in the art of making breakfast cereals. Finally those with experience in the art of making sprouted-grain breakfast cereals are usually only familiar with the cooker extruders and flaking rollers made for that purpose.

Brief Summary Paragraph Table (1):
Temperature (C.) Temperature (F.) % Relative Activity 40.degree. 104.degree. 100 45.degree. 113.degree. 100 50.degree. 122.degree. 91 55.degree. 131.degree. 80 60.degree. 140.degree. 69 65.degree. 149.degree. 48 70.degree. 158.degree. 2 (4) When we eat enzyme deficient food, our bodies are forced to draw upon their own limited store of enzyme energy to begin the digestion of this food thus depleting it and hastening the onset of degenerative diseases. (5) Raw unsprouted grains, seeds, and nuts contain large amounts of enzyme inhibitors which also deplete the body's limited store of enzyme energy when consumed. (6) Therefore it is wise to consume as much of our food as possible in the raw form and to avoid consuming grains, seeds, and nuts (unless they have first been sprouted), in order to conserve and, to a small extent, replenish our store of enzyme energy thus postponing the onset of degenerative diseases. (It has been found, however, that

the negative effect of the enzyme inhibitors in raw unsprouted seeds is more than overcome by the enzymes in an equal amount of raw sprouted seeds if they are consumed at the same time.)

Brief Summary Paragraph Table (2):
Genera Habitat Leuconostoc the surface of plants Lactobacillus plant surfaces, manure, dairy products Streptococcus raw milk, manure, green plants, feeds, silage Pediococcus vegetables As sprouted grain is crushed, the lactic acid bacteria which were on the surface of the grain sprouts, are now in the ground sprout batter where they begin a fermenting action which will eventually convert large amounts of the sugars in the ground sprouts to lactic acid. Initially, the pH of these ground sprouts is about 6.0. Dehydration is then used to lower the water activity of the ground sprouts to a level where the resultant product will be shelf-stable. (The term "water activity" (a.sub.w) is used herein in its usual context to mean the ratio of the fugacity of water in the system being studied (f) to the fugacity of pure water (f.sub.o) at the same temperature. Hence the water activity of pure water is 1.00. The water activity of the products and compositions herein can be measured using well-known physical chemical techniques and commercially available instruments.) But, before the dehydration process reduces the water activity of the ground sprouts to a level where such fermenting activity can no longer continue, a sufficient amount of sugar will have been converted to lactic acid to lower the pH of the drying batter to about 4.6, a drop in pH of 1.4. This pH drop of 1.4 is due solely to the formation of lactic acid in the batter as it dries, and this lactic acid imparts a very sour taste to the product. We expect sauerkraut and pickles to taste sour but even the most avid health enthusiasts find it difficult to enjoy sour tasting bread. (Please see .sctn.3.1 for the method by which the pH drop due to lactic acid formation in a product, .delta.pH.sub.LA, is to be determined. The LA in .delta.pH.sub.LA stands for Lactic Acid.)

Brief Summary Paragraph Table (12):
Group of Microorganisms Minimal a.sub.w value Many bacteria 0.91 Many yeasts 0.88 Many molds 0.80 Halophilic ("salt tolerant") bacteria 0.75 Xerophilic ("drought tolerant") fungi 0.65 Osmophilic ("high osmotic pressure 0.60 tolerant") yeasts According to this table, the minimal water activity required to support the growth of many bacteria is 0.91. Only those bacteria which require or thrive on a high level of salt can grow at a lower activity than 0.91. If, however, an amount of a syrupy type of water activity depressant were added to the liquid into which the sprouts and pieces of absorbent vegetal matter are to be stirred sufficient to lower the water activity of that liquid below 0.60, so as to suppress all microbial activity, the liquid becomes too thick to have stirred into it the milled dried sprouts and pieces of absorbent vegetal matter. And even if it were possible to disperse the sprouts and pieces of absorbent vegetal matter evenly throughout the liquid, it would be too sweet (if a sweet water activity depressant were used) or too salty (if a salt were used for the water activity depressant) to be considered a healthy or appetizing food for humans. Furthermore the resultant batter would be too thick and too gooey to be successfully spread on the dehydrator screens. Applicant has discovered that it is sufficient to add just enough of a water activity depressant to the liquid to lower the water activity of that liquid below 0.91 for sugar based water activity depressants and below 0.75 for salt based water activity depressants. A water activity lower than 0.91 (or 0.75 if salt is used) suppresses the growth of lactic acid bacteria. Now when the sprouts and pieces of absorbent vegetal matter are stirred in, the water activity of the resultant batter drops a bit further. Now that the growth of lactic acid bacteria has been suppressed, the other methods of this invention are used to quickly lower the water activity of the cracker batter below 0.60 before the much slower growing yeasts and molds have a chance to make their appearance. Thus not only is the growth of all microorganisms effectively suppressed, but this minimal addition of a water activity depressant to the liquid into which the sprouts and pieces of absorbent vegetal matter are to be stirred, leaves this liquid still thin enough that the sprouts and pieces of absorbent vegetal matter can easily be stirred into and

evenly dispersed throughout the liquid thus leading to a very successful product. It should also be pointed out that the more water activity depressant that is used in the liquid into which the sprouts and pieces of absorbent vegetal matter are to be stirred, the higher will be the osmotic pressure of the liquid, and the less able will the pieces of absorbent vegetal matter be to absorb water from the batter to thicken it before the batter is spread on dehydrator screens. (Osmotic pressure is the force created across a semipermeable membrane--in this case, the cell walls of the pieces of absorbent vegetal matter--separating two solutions of different concentrations. It results in the passage of water from the region of its greater concentration to a region of its lesser concentration.) Thus the use of this method causes method 2 to lose some of its effectiveness. In fact, if enough water activity depressant is used to lower the water activity of the liquid below 0.60, the pieces of absorbent vegetal matter will absorb no water from the batter, and it will not be possible to spread the batter on dehydrator screens; the batter will leak through the screen apertures making quite a mess. Hence, the less water activity depressant that is added, the easier the batter will be to handle. (3B) For the Liquefied Sprouts Based Crackers, mixing the sprouts with a water activity depressant prior to liquefying them in a food processor. Here, however, if one wished to add a sufficient amount of a water depressant to the sprouts before liquefying them to ensure that the resultant batter would have a water activity below 0.60, so as to suppress all microbial activity, the amount of water activity depressant which would have to be added would be enormous since nondehydrated sprouts are more than 40% water. Such a batter could not yield desirable results. So, here, again, it is sufficient to add just enough of a water activity depressant to the sprouts to lower the water activity of the resultant liquefied sprouts/water activity depressant mixture below 0.91 (below 0.75 if salt is used). And again, dehydration is used to quickly lower the water activity below 0.60 before the much slower growing yeasts and molds have a chance to make their appearance. Thus again not only is the growth of all microorganisms effectively suppressed, but this minimal addition of a water activity depressant to the sprouts before liquefying them, leaves the resultant liquefied batter still thin enough that the pieces of absorbent vegetal matter can easily be stirred into and evenly dispersed throughout the batter thus leading to a very successful product. And again, it should also be pointed out that the more the amount of water activity depressant that is added to the sprouts that are to be liquefied, the higher will be the osmotic pressure of the resultant liquefied batter, and the less able will the pieces of absorbent vegetal matter which are stirred into this batter be to absorb water from the batter to thicken it before the batter is spread on dehydrator screens. Thus the use of this method again causes method 2 to lose some of its effectiveness. Here again, the less water activity depressant that is added to the sprouts before liquefying them, the easier the resultant batter will be to handle. (4) For the Sprout Flour Based Crackers, when a syrupy type water activity depressant is used, utilizing as little water as possible in the liquid into which the sprouts and pieces of absorbent vegetal matter are to be stirred, so that liquids with a water activity in excess of 0.91 can be used. While, for example, a solution with a water activity of 0.92 is somewhat retarding bacterial souring, dehydration is so quickly carrying the water activity below 0.91, that bacterial souring never really has a chance to get started. The advantage in using as little water as possible, and, hence, as little of a syrupy type water activity depressant as possible, is that a softer more easily chewed cracker is obtained. The more of a syrupy type water activity depressant that is used, the harder the end product will be, making mastication difficult. Furthermore, the less water that is used, the less water activity depressant need be used to maintain the water activity of the liquid at a level required to prevent bacterial souring. Since all of the sweet syrup type water activity depressants contain sugar, the less that is used, the better inasmuch as large amounts of sugar have not been found to be conducive to good health. In addition, if only minimal amounts of water are used, dehydration proceeds much more quickly. This can add up to quite an energy saving. (5) Having spread a very thick batter onto double-access drying surfaces (such as dehydrator screens), slicing the batter periodically (every half hour or so) into small square

or rectangular slices. Due to the semi-liquid nature of the drying batter just below its surface, it tends to ooze back into the slice marks, and it is therefore necessary to reslice the batter every half hour or so until it no longer oozes back into the slice marks. By slicing the batter into very small squares or rectangles, the batter just below the surface and all the way down to the dehydrator screen is exposed to the drying air, (even if, initially, for only a minute or so) thus greatly speeding up the drying process and eliminating any possibility of fungal or mold growth. Further, with the larger batch sizes now possible, commercial production of these products is now feasible. Further, the smaller the size of the square or rectangular slices into which the batter is sliced, the shorter the time it will take to dry, and the less time the fermentative bacteria will have to ferment the batter from which the crackers are made. And the greater the energy saving will be. (It should also be noted that spreading the batter as thick as possible results in a tremendous cost savings: the more batter that is spread on each screen, the fewer the number of screens required to spread a given batch of batter and thus, the fewer the number of trays which must be purchased. There is also a labor savings as well: fewer screens and trays need be cleaned afterward.) (6) Preparing the cracker batter with carbonated rather than with plain water. Using carbonated water results in a somewhat more porous product and a slightly faster drying time. Consequently there is somewhat less souring in the product, and the resultant product is somewhat easier to chew. According to page 1010 of Volume 16 of the Encyclopaedia Britannica, carbon dioxide gas gives carbonated beverages their sparkle and tangy taste and prevents spoilage. The amount of gas which water will absorb increases as the pressure is increased and the temperature is decreased. (7) Maintaining the temperature of the atmosphere about the drying batter between 90.degree. and 104.degree. F. Lower temperatures unduly lengthen drying time, thus giving fermentative organisms more time to produce lactic acid. (8) Heating the cracker batter to a temperature of 104.degree. F. before stirring in the pieces of absorbent vegetal matter and then maintaining the cracker batter at a temperature of 104.degree. F. until it is spread on dehydrator screens. Heating the batter to 104.degree. F., results in a slightly less viscous batter which makes it somewhat easier to stir in the pieces of absorbent vegetal matter. Furthermore, due to the lower viscosity of the batter, less water need be used to make the batter, thus resulting in a shortened dehydration time and lower energy costs. In addition, when the batter is maintained at a temperature of 104.degree. F., the batter dries faster thus giving fermentative organisms less time for their souring activity, and thus yielding a better tasting product with a somewhat higher pH value. (9) Dehydrating the cracker batter at a temperature in excess of 104.degree. F. (but less than 118.degree. F.). Lower temperatures unduly lengthen the dehydration process giving fermentative bacteria the opportunity to produce more lactic acid. In addition a longer dehydration time increases the chances of mold and fungal growths. (But it is imperative that the dehydration temperature be kept below 118.degree. F. as higher temperatures destroy food enzymes.) Dehydration has three parameters: temperature, the relative humidity of the atmosphere about the drying product, and air flow velocity over the surfaces of the product. The time to dehydrate a given mass of cracker batter varies inversely with temperature and air flow velocity and varies directly with humidity. Therefore, most preferredly, the temperature will be maintained at about 104.degree. F., humidity will be maintained below 45 percent and as much lower than that as is feasible, and the velocity of air flow over the drying surfaces of the batter shall be made as high as possible without being so strong that the cracker batter is blown about. (10) Using as little water as possible in the cracker batter. The less water used in the cracker batter in proportion to the other ingredients, the shorter will be the dehydration time and the greater will be the energy savings. (11) Each of these methods contributes somewhat to reducing .delta.pH.sub.LA, the pH drop due to lactic acid souring in the batter as it dries. For example, Methods 1 and 8 done without Methods 2 and 5 does not result in a sufficiently reduced pH drop to yield an acceptable product. For a commercially acceptable product, at least methods 1, 2, 5, 7, and 9 should be used.

Detailed Description Text (10):
The Model FD 1000 Food Dehydrator is a 4 tray dehydration unit (with optional additional trays) which has a circular base unit containing a motorized fan and a core filament heating element. The trays of material to be dehydrated are stacked on the circular base unit, the insulated cover is placed on the top tray, the desired temperature is selected via a rotary dial, and the power is turned on. The construction of the circular interlocking trays allows warm air currents to flow in a circular pattern from the bottom tray to the top tray thus providing fast even drying. Due to the design and strength of the fan motor, the circular trays can be stacked thirty high. For dehydrating liquids, a circular solid sheet (Alternative Pioneering Systems' registered trademark name is "Fruit Roll-Up Sheets") is placed in each tray before pouring in liquids. For dehydrating solids, a circular screen (registered trademark name is "Clean-A-Screens") is placed in each tray before putting the solids in the trays. Except for the fact that this particular model dehydrator seems to dry much faster than the other models I have used, the type of dehydrator used is probably not critical to the success of the methods used to make NP CLASS Crackers or RUSTIC Sprouted Seed Products.

Detailed Description Text (12):
The Kitchen Mill.TM. Electric Flour Mill (U.S. Pat No. 4,203,555 to Dickson (1980)), however, contributes greatly to the success of my methods. The milling chamber's concentric spinning metal sections which burst the seeds into flour do not actually touch which results in a cooler milling operation than with most other flour mills. Furthermore, the ease with which an 8 inch stem thermometer may be mounted transversely in the flour mill's Lexan.TM. Flour Pan just below the point where the flour leaves the milling chamber, makes it easy to monitor the temperature of the sprouts as they are being ground. When the temperature gets too high, one need only turn off the mill and refrigerate it (or let it cool) until the temperature is once again safe for the vital nutrients in the sprouts. And since this mill does not use grinding stones, there is no possibility that stone grit will mix with the flour. A further advantage of this particular flour mill is that it is self cleaning.

Detailed Description Text (20):
The first step in sprouting seeds is to soak the selected seeds for between five and ten hours in either filtered or distilled water. (The optimal soak times for many seeds can be found on pages 72-73 of The UNcook Book by Elizabeth and Dr. Elton Baker (Communication Creativity, Saguache, Colo. (1980).) The temperature of the water in which the seeds are soaked must be below 45.degree. C. (Higher temperatures would destroy the seeds' ability to sprout.) In general, this temperature is between 20.degree. and 30.degree. C. Next, the selected seeds are sprouted in an environment whose air temperature is between 15.degree. and 30.degree. C. (It should be noted that during the first few hours of any subsequent dehydration, the seeds sprouts still retain sufficient moisture to continue growing which brings about a further increase in enzymes, especially alpha amylase, and a further decrease in enzyme inhibitors.) If some seeds such as wheat, however, are sprouted for much longer than 24 hours, they begin to develop an objectionable sweet taste. Many seeds if they are sprouted for longer than about 24 hours, due to the lengthening of their roots and shoots, tend to become tangled which makes it difficult to feed them into the hopper of a flour mill after dehydration. (1) Carefully inspect the seeds it is desired to sprout. Remove all extraneous matter such as pebbles, dirt, staples, shotgun pellets, bits of metal, and badly discolored or otherwise defective seeds. (2) Wash the seeds in a solution containing 1/2 ounce of 3% strength food grade hydrogen peroxide per gallon of wash water. This washing will reduce the fungal population on the surface of the seeds. (3) In a glass, stainless steel, or plastic container of suitable capacity which complies with FDA regulations, pour one pint of distilled water for every pound of seeds it is desired to sprout. Add 1/8 of an ounce of 3% strength food grade hydrogen peroxide for every pint of water. (The hydrogen peroxide acts to inhibit fungal growths on the sprouts as they are growing, and also leads to a more

abundant crop of sprouts.) (4) Stir the seeds into the solution of step 3. (5) Allow the seeds to soak in this solution for the optimal soak time for the type of seeds selected. (The optimal soak times for many seeds can be found on pages 72-73 of The UNcook Book by Elizabeth and Dr. Elton Baker (Communication Creativity, Saguache, Colo. (1980)). For example, after ten hours of soaking, wheat grain will have absorbed just about as much liquid as it is capable of absorbing. (6) Place a large strainer over the mouth of the container used for soaking the seeds, and, holding the strainer tightly against the mouth of the container, tip the container and drain all the solution from the container. The container now contains just the soaked seeds. Rinse the soaked seeds by filling the container with fresh filtered or distilled water and draining again. Record the time at which you complete this step. Step 8 should be performed six hours after step 6. (7) The circular trays plus insulated cover of the Model FD-1000 Food Dehydrator can be used to construct an excellent seed sprouter as shown in the following steps. Please note, however, that the circular screens of step (b) are only suitable for seeds larger than the hole openings of the screens. For sprouting smaller seeds, suitable screen material may be obtained from Alfa III Corporation, Chaska, Minn. (The seed sprouter as set up will have about one tray for each pound of soaked seeds.) (a) Pour two cups of water into an 181/2 inch diameter stainless steel basin. The two cups of water provide the proper humidity for the growing sprouts. (b) Place a circular screen in a circular food dehydrator tray of the Model FD-1000 Food Dehydrator. You will notice that the screen has two semi-circular cutouts on opposite edges of the screen to enable one to more easily lift the screen out of the tray. When seeds are spread on the screen, some of the seeds close to these cutouts may fall through. To remedy this situation, place a second screen in the tray so as to cover the cutouts of the first screen, thus preventing the seeds from falling through. (c) Place the dehydrator tray containing the two screens on a large pizza platter. (d) Spread 2 pints of the soaked seeds evenly over the surface of the upper circular screen in the dehydrator tray. (e) Carefully lift the dehydrator tray off of the pizza platter and place it in the stainless steel basin. (f) Repeat steps b through e, placing each newly prepared dehydrator tray on top of the last dehydrator tray which was placed in the stainless steel basin (thus forming a stack of dehydrator trays in the basin), until all of the soaked seeds have been placed in dehydrator trays. (g) Place an empty dehydrator tray on top of the last dehydrator tray placed on the stack of dehydrator trays. Put several wet napkins in this tray to provide extra humidity for the growing sprouts in the trays below. (h) There is now a stack of dehydrator trays in the stainless steel basin. Place the insulated dehydrator cover on the top dehydrator tray to provide the sprouts a humid environment in which to grow. The hole in the insulated cover provides sufficient fresh air for the growing sprouts. Due to the much poorer aeration of the sprouts in the lower trays, it is recommended that not more than about ten trays be stacked in this way.) (8) Six hours after performing step 6, fill a large stainless steel drum with enough water to cover the top tray of the seed sprouter set up in step 7 when it is submerged in the stainless steel drum. It is very important that this water be either distilled or filtered water; the chemicals added to municipal water may retard the growth of the sprouts. (9) Add one ounce of 3% strength food grade hydrogen peroxide for each gallon of water in the drum. (Not all of the seeds will sprout, and the seeds that do not sprout have a tendency to mold. The food grade hydrogen peroxide inhibits these seeds from molding.) (10) Remove the insulated dehydrator cover. Using a good quality butchers twine, tightly tie together the stack of trays from top to bottom such that it will hold together when you immerse this stack of trays in the water in the drum. (11) Using the portion of the butchers twine stretched across the top tray as a handle, slowly lower the stack of trays minus the insulated cover into the stainless steel drum until the top tray of the stack of trays is submerged. Wait 10 seconds while the sprouts soak. (12) Slowly raise the stack of trays from the drum of water, tip the stack of trays to facilitate drainage, allow to drain for 10 seconds or so, and place the stack of trays back in the stainless steel pan. Replace the insulated cover. (13) Every six hours until one hour before the time selected at which to stop sprouting, remove the dehydrator cover, and repeat steps 11 and 12. (If, however, it is desired to

sprout the seeds for longer than 24 hours, the water in the drum should be replaced with fresh water and one ounce of 3% strength food grade hydrogen peroxide added per gallon of water.) (14) One hour before the time selected at which to stop sprouting, again remove the dehydrator cover, and repeat steps 11 and 12. (15) One hour after step 14, the seeds have now sprouted for the desired length of time. Remove the twine holding the stack of trays together, and refrigerate the sprouts until they are ready to be used. (It should be noted, however, that the sprouts will continue to grow, albeit slowly, in the refrigerator.)

Detailed Description Text (21):
5.3.2 Mounting the Thermometer in the Lexan.TM. Flour Pan of the Kitchen Mill Flour Mill (1) The Flour Pan is 10" long, 81/4" wide and 51/4" deep. Using a 9/64" drill bit, drill a hole in one of the longer side walls of the flour pan, which hole is 5/8" below the rim of the flour pan and 4" along the length of the flour pan. (2) Drill a corresponding hole in the opposite side wall of the flour pan such that the 8" stem of the thermometer may be inserted through one of these holes, pushed across the opening of the pan, and through the hole on the opposite side of the pan. (3) Now push the stem of the thermometer through the first of the two holes and continue pushing it until the tip of the stem passes through the second of the two holes. (4) Attach the assembled cyclo cup to the bottom of the mill as explained in The Kitchen Mill Owner's Manual and Use Guide. (5) Mount the mill on the flour pan such that the stem of the thermometer nearly touches the assembled cyclo cup. (6) As the dried sprouts are milled, the sprout flour will fall on the long stem of the thermometer, and the circular dial of the thermometer just outside the wall of the pan will record the temperature of the sprout flour.

Detailed Description Text (26):
The method for using the Kitchen Mill Flour Mill for milling sprouts is as follows: (1) Refrigerate the flour mill until its mounted thermometer reads less than 50.degree. F. (2) Measure out the required amount of dried sprouts. (3) Select the Kitchen Mill's "Fine Flour Texture Setting" by turning the arrow on the rotary dial to the smallest dot, and turn on the Kitchen Mill. (4) Place 1 cup of dried sprouts in the hopper of the mill. Thedried sprouts will be milled to flour and fall onto the long stem of the thermometer mounted transverse the flour mill pan. Whenever the thermometer records a temperature greater than 104.degree. F., refrigerate the mill until the temperature has dropped below 70.degree. F. and continue milling the flour. Continue in this way until all the sprouts are milled.

Detailed Description Text (53):
When milling hulled dehydrated sprouts and certain thin-hulled dehydrated sprouts like millet and teff, the mill should be set at its "Fine Flour Texture Setting" (the dial position indicated by the smallest dot) and the sprouts need only be milled once. For thick-hulled sprouts like sunflower and oats, it is advantageous to mix the thick-hulled sprouts with hulled or thin-hulled sprouts prior to milling them in order to reduce heat buildup while milling. The temperature of the flour should be carefully monitored while milling and, if the temperature should climb past 118.degree. F., the mill should be allowed to cool before continuing in order to assure that the delicate enzymes in the sprouts are not damaged. The mixture of thick hulled sprouts and hulled or thin-hulled sprouts is now milled with the mill set at its "Coarse Flour Texture Setting" (the dial position indicated by the largest dot) and generally needs to be milled again with the mill set at its "Fine Flour Texture Setting" before the resultant flour is fine enough to be used to make cracker batter.

Detailed Description Text (56):
The very first step is to ensure that the relative humidity of the atmosphere in the Preparation Room is less than 45% since it is desired to reduce the water activity of the cracker batter below 0.45. If the relative humidity at any time is allowed to climb above 70%, fungal growths and mold are encouraged which will result in an unacceptable product. While dehydration of the cracker batter is in

progress, it is desirable that the temperature of the atmosphere about the drying batter be maintained in the range 90-104.degree. F. A warm dry atmosphere about the drying batter is most conducive to rapid dehydration and minimal chances of microbial growth.

Detailed Description Text (67):
It is advantageous to heat and maintain the batter on the flat surface at a temperature of 104.degree. F. The setting time need not exceed about 60 minutes, for by that time the pieces of absorbent vegetal matter in the batter will have absorbed most of the liquid they would eventually absorb. For example, the following table shows the amount of water which one pound of various kinds of soft seeds will absorb as a function of time: (As can be seen, the kinds of soft seeds are sesame and poppy. If sliced oats or sunflower seeds are used, nearly twice as much is required to have the same effect.)

Detailed Description Text (69):
After setting for the required length of time, the cracker batter is sliced into convenient sized slices. Circular dehydrator screens are now placed in dehydrator trays and the slices of batter are carefully lifted and placed on the dehydrator screens. The trays are then placed on the dehydrator base unit, the insulated cover is placed on the top tray, the dehydrator temperature dial is set to 104.degree. F., and the dehydrator power switch is turned on. In order to minimize dehydration time: 1) the relative humidity of the area in which the batter is being dehydrated should be below 45% and as much lower than that as is feasible, and 2) the velocity of air flow over both the upper and lower drying surfaces should be as high as is feasible. It should be noted that if a high enough air velocity over the drying surfaces is maintained, a dehydration temperature of room temperature will be sufficient to obtain a greatly reduced dehydration time. Further, if a high enough air velocity over the drying surfaces is maintained, it can be found advantageous to lower the temperature of the drying area to about 33.degree. F., this low a temperature serving to greatly impede fermentative souring of the batter.

Detailed Description Text (92):
5.5.4.2.1 Dehydrating the Sprouts: (1) At this point, ensure that the temperature of the atmosphere in the Preparation Room is above 90.degree. F. Lower temperatures unduly lengthen drying time. Also use a dehumidifier to reduce the relative humidity of the atmosphere in the Preparation Room to less than 45% to speed up the drying of the sprouts and to reduce the possibility of fungal growths while the sprouts are drying. (2) Make sure that the sprouts are still spread evenly on each tray. If they are not spread evenly, clumps of sprouts will still be moist on the inside after the sprouts surrounding them have dried. (3) Place the stack of dehydrator trays (minus the top tray which contained the wet napkins) on the dehydrator base unit which contains the heater and fan. Put the insulated dehydrator cover back on top of the stack of trays. (4) Using the rotary temperature selection dial of the dehydrator, select a temperature of 104.degree. F. (40.degree. C.), turn on dehydrator power, and dehydrate the sprouts until their water activity has been reduced below 0.60, and preferably below 0.45. It is preferred to use a dehydrator which has means for varying the velocity of air over the drying surfaces of the batter. This velocity varying means should be set to its highest feasible setting in order to minimize dehydration time. The dehydrator which applicant used does not have means for raising the air velocity above its preset level. (5) Prepare a 2:1 slurry from 2 ounces of distilled water and 1 ounce of dried millet sprouts. Measure and record the pH of the 2:1 slurry. In a similar manner, prepare a 2:1 slurry from 2 ounces of distilled water and 1 ounce of dried wheat sprouts. Measure and record the pH of the 2:1 slurry. (6) Transfer the sprouts into covered storage containers and refrigerate until ready to be used. As long as the dried sprouts are adequately refrigerated, they should keep for a year or more with little, if any, deterioration.

Detailed Description Text (96):

NOTE: This method calls for measuring the water activity of the drying b
12 hours in order to demonstrate that the water activity of the drying b
been reduced below 0.60 before the 48th hour of dehydration has elapsed.
the cracker batter should only be made at a time when it will be conveni
measure its water activity every 12 hours thereafter. (In this method an
following methods, if it is inconvenient to measure water activity at a
hour point, it is acceptable to obtain readings at times which are on eit
of the 12 hour point and to interpolate to obtain the desired reading.) (1) Set up the Kitchen Mill.TM. electric flour mill with a thermometer mounted across the flour pan as specified in the "Setup of Equipment Used in Manufacture of Invention" section (.sctn.5.3.2) of this patent application. (2) Using the method for milling sprouts as described in the "Operation of Equipment Used in Manufacture of Invention" section (.sctn.5.4.1) of this application, mill 14 ounces of dried millet sprouts and 14 ounces of dried wheat sprouts. (For a somewhat firmer cracker, mill 7 ounces of dried millet sprouts and 21 ounces of dried wheat sprouts instead. Since glutinous ingredients require somewhat more water to form an easy to stir batter than nonglutinous ingredients, between 29 and 30 ounces of carbonated distilled water will be required at step 4 rather than 28 ounces in order to make an easy to stir batter.) (3) Ensure that the temperature of the atmosphere in the Preparation Room is between 90.degree. F. and 104.degree. F. Lower temperatures unduly lengthen drying time. Also use a dehumidifier to reduce the relative humidity of the atmosphere in the Preparation Room to less than 45% to speed up the drying of the sprout batter and to reduce the possibility of fungal growths while the sprouts are drying. (4) Dilute 32 ounces of carbonated distilled water with distilled water until its pH value is 4.0. Pour 28 ounces of carbonated distilled water into a suitably sized round stainless steel or plastic container (the mixing container) which complies with FDA regulations. Pour the unused carbonated distilled water into an open container; its pH value will be measured at step 8 of this section. (5) Stir the sprout flour made at Step 2 into the container of step 4. Continue stirring until all the sprout flour is thoroughly wet. The result at this point should be a somewhat easy to stir sprout mixture. (The absorption of this solution by the dried sprout flour is called rehydration.) The sprout solids to water ratio (SS/H20) here is 28/28=1.000. (6) While stirring vigorously in a circular motion, slowly pour 28 ounces of whole hulled and preferably soaked and dried sesame seeds into the mixing container near its inside wall, and continue to stir vigorously for several minutes more to ensure that the sesame seeds are uniformly distributed throughout the batter. (The total weight of this mixture is 84 ounces=5 pounds 4 ounces.) Heat this batter to 104.degree. F. (7) The batter for the Cheesy Variety consists of 14 ounces of dried millet sprouts, 14 ounces of dried wheat sprouts,. 28 ounces of carbonated distilled water, and 28 ounces of sesame seeds. Thus, total solids is 56 ounces, and the total water is 28 ounces. (Thus the batter is two-thirds solids and one-third water, and this water is 100% carbonated distilled water.) Remove 2.5 ounces of batter. Determine the pH value of a 2:1 slurry of this batter as follows: 2.5 ounces of this batter consists of 0.833 ounces dried sprouts, 0.833 ounces sesame seeds, and 0.833 ounces carbonated distilled water. In other words, this batter consists of 1.667 ounces of solids and 0.833 ounces of water. Add 2.5 ounces of distilled water to the 2.5 ounces of batter to make a 2:1 slurry, and stir well. Its composition, is now 3.333 ounces water and 1.667 ounces of solids. Measure the pH value of this slurry. It should be about 6.0. Call the measured pH of this 2:1 slurry pH.sub.o. (8). Now measure the pH value of the unused portion of diluted carbonated distilled water set aside at step 4. The carbonated distilled water to be used at step 12 of .sctn.5.5.4.3 should first be diluted with distilled water until it has the same pH value as the unused portion whose pH value was just measured in this step. (9) At this point, proceed to .sctn.5.5.4.3, "Dehydrating the Batter".

Detailed Description Text (98):
NOTE: This method calls for checking the water activity of the drying batter every 12 hours in order to demonstrate that the water activity of the drying batter has been reduced below 0.60 before the 48th hour of dehydration has elapsed. Therefore,

the cracker batter should only be made at a time when it will be convenient to check its water activity every 12 hours thereafter. (1) Preheat raw unfiltered honey to 104.degree. F. to reduce its viscosity. Dilute 20.1 ounces of carbonated distilled water with distilled water until its pH value is 4.0. Pour 16.1 ounces (= (28* 0.575)) of carbonated distilled water into a suitably sized round stainless steel or plastic container (the mixing container) which complies with FDA regulations. Pour the unused carbonated distilled water into a separate open container; its pH value will be measured at step 9 of this section. (2) Pour 16.1 ounces of honey into the mixing container, and stir until the honey is completely dissolved. (Since Nickabood's Sage Honey is 12% water, 16.1 ounces of honey contains 0.88*16.1=14.168 ounces of honey solids. Therefore, the solution made in this step is 44% honey which seems high. The weight of the dehydrated crackers will be about 70 ounces of which 14.168 ounces or about 20% is honey solids, which is low! That is one of the surprising things about this invention: Although the initial preparation solution is 44% honey, thus crippling bacterial souring, the final product contains surprisingly little honey percentagewise (only about 20%).) Now check the water activity of this aqueous honey mixture. If the water activity is greater than 0.85, the honey has a high moisture content and should not be used. If it is still desired, however, to use this honey, add additional honey until the water activity of the liquid drops below 0.85. Now remove liquid from the mixing container until 32.2 ounces of liquid remain in the mixing container. (3) Set up the Kitchen Mill.TM. electric flour mill with a thermometer mounted across the flour pan as specified in the "Setup of Equipment Used in Manufacture of Invention" Section (.sctn.5.3.2) of this patent application. (4) Using the method for milling sprouts as described in the "Operation of Equipment Used in Manufacture of Invention" Section of this application (.sctn.5.4.1), mill 28 ounces of the dried millet sprouts from .sctn.5.5.4.2.1 step 6. (5) At this point, ensure that the temperature of the atmosphere in the Preparation Room is between 900 F and 104.degree. F.. Lower temperatures unduly lengthen drying time. Also use a dehumidifier to reduce the relative humidity of the atmosphere in the Preparation Room to less than 45% to speed up the drying of the sprouts and to reduce the possibility of fungal growths while the sprouts are drying. (6) Stir the sprout flour made at step 4 into the container of step 2. Continue stirring until all the sprout flour is thoroughly wet with the solution. The result at this point should be a somewhat easy to stir sprout mixture. (The absorption of this solution by the dried sprout flour is called rehydration.) The sprout solids to water ratio (SS/H2O) here is 28/(16.1+0.12*16.1)=1.553. (7) While stirring vigorously in a circular motion, slowly pour 28 ounces of whole hulled and preferably soaked and dried sesame seeds into the mixing container near its inside wall, and continue to stir vigorously for several minutes more to ensure that the sesame seeds are uniformly distributed or dispersed throughout the batter. (The total weight of this mixture is 88.2 ounces=5 pounds 8.2 ounces.) Heat this batter to 104.degree. F. (8) The batter for the Sweet Variety of crackers consists of 28 ounces of dried millet sprouts, 14.168 ounces honey solids, 16.1 ounces of carbonated water, 1.932 ounces of water contributed by the honey, and 28 ounces of sesame seeds. Thus, the total solids is 70.168 ounces, and the total water is 18.032 ounces. (Thus the batter is 79.556% solids and 20.444% water of which 89.29% is carbonated distilled water.) Remove 2.0 ounces of batter. Determine the pH value of a 2:1 slurry of this batter as follows: 2.0 ounces of this batter consists of 0.635 ounces dried sprouts, 0.635 ounces sesame seeds, and 0.365 ounces carbonated distilled water, and 0.365 ounces of sage honey. Since sage honey is 12% water, the 0.365 ounces of honey contributes 0.0438 ounces of water and 0.32 ounces of honey solids to the 2.0 ounces of cracker batter. Or, in other words, the 2.0 ounces of cracker batter consists of 1.59 ounces of solids and 0.41 ounces water. Add 2.77 ounces of distilled water to the 2.0 ounces of batter to make a 2:1 slurry, and stir well. Its composition, is now 3.18 ounces of water and 1.59 ounces of solids. Measure the pH value of this 2:1 slurry. It should be about 5.8. Call this measured value pH.sub.o. (9) Now measure the pH value of the unused portion of diluted carbonated distilled water set aside at step 1. The carbonated distilled water to be used at step 12 of .sctn.5.5.4.3 should first be diluted with distilled water until it has the same pH value as the

unused portion whose pH value was just measured in this step. (10) Proceed to .sctn.5.5.4.3, "Dehydrating the Batter".

Detailed Description Text (99):
5.5.4.3 Dehydrating the Batter (1) Place an 18 by 18 inch sheet of white paper on a flat surface. Place the screen-form made by the "Method of Manufacture of Despoked Trays and Screen Forms" described in .sctn.5.3.3 of this specification in the center of the white sheet of paper. Place a 1/4th inch thick flat sheet of transparent lead-free glass or FDA approved plastic over the pieces of paper. The outline of the black screen-form can now be seen through the glass or plastic sheet. (2) Record the time. Pour 5 pounds of batter on the glass or plastic transparent sheet just over the place where the screen-form can be seen through the transparent sheet. Contour the batter to the shape of the screen-form as seen through the transparent sheet. Spread the batter smoothly to a uniform thickness on the transparent sheet avoiding the central hole of the screen-form as seen through the transparent sheet. (Or, the batter may be spread uniformly within the outer circumference of the screen-form as seen through the transparent sheet even covering up the central hole. Then a hole can be formed in the middle of the batter the same size as the central hole as seen through the transparent sheet.) (3) Record the time. Remove 2 ounces of batter, and measure and record its water activity. It should be about 0.92 for the Cheesy Varieties of NP CLASS Crackers and about 0.80 for the Sweet Varieties of NP CLASS Crackers. (4) As the batter rests on the transparent sheet, the sesame seeds in the batter gradually absorb liquid from the batter making the batter firmer and sturdier. Eventually a point in time is reached where the batter is sufficiently sturdy that it can be sliced and lifted off of the transparent sheet without breaking apart. Therefore, let the batter on the transparent sheet set until it is firm enough to be sliced and lifted off the transparent sheet with a spatula without breaking. (This time should be in the order of about 45 minutes, but no longer than about 90 minutes (from the time recorded at step 2), or significant souring will take place when the Cheesy Varieties of NP CLASS Crackers are being made.) When the batter has become sturdy enough to be lifted off of the transparent sheet without falling apart, it is also of sufficient firmness to be placed on a screen without significant leakage through the screen apertures. (5) Slice the batter lengthwise into long slices (no more than about 2 inches wide). Measure the length of the blade of the spatula to be used at step 6 to lift the slices of batter off of the transparent sheet, and slice the batter crosswise into pieces of that length. (6) Place a circular screen in a dehydrator tray. Using a spatula, lift the slices of batter off the transparent drying sheet and place on the circular screen, so that the slices are parallel to one another with slight spaces between the individual slices (for ventilation purposes). These long slices of batter should fit perfectly onto a single dehydrator screen. Now, slice the 2 inch wide batter slices into 1/2 inch by 1/2 inch squares--substantially bigger pieces will allow significant souring to take place (in the Cheesy Varieties) before the water activity of the pieces has been reduced below 0.60. (7) Place the dehydrator tray with its slices of batter onto the dehydrator base unit. Place the despoked tray made by the "Method of Manufacture of Despoked Trays and Screen Forms" described in .sctn.5.3.3 of this Specification above the dehydrator tray having the batter. Now place an empty dehydrator tray on the despoked dehydrator tray. (This provides additional "head room" and ventilation for the drying batter.) (8) Place the insulated dehydrator cover on the top tray to minimize loss of heat during the dehydration process. Set the ~~rotary~~ temperature selection dial to indicate a temperature of 104.degree. F. (~~40.degree. C.~~). Turn on the dehydrator, and record the time. It is preferred to use a dehydrator which has means for varying the velocity of air over the drying surfaces of the batter. This velocity varying means should be set to its highest feasible setting in order to minimize dehydration time. The dehydrator which applicant used does not have means for raising the air velocity above its preset level. (9) Thirty minutes after the completion of step 8, and every 30 minutes thereafter for the next 3 hours, reslice the drying batter along the slice marks of steps 5 and 6, and put the tray back on the dehydrator base unit. Replace the

insulated dehydrator cover. (10) Twelve hours after the time recorded in Step 3 and every 12 hours thereafter, remove 2 ounces of the drying batter, and measure and record its water activity. (Since the drying pieces of batter become somewhat "case-hardened" as they dry, it is recommended that these pieces be pulverized before measuring their water activity.) When the water activity of the drying batter drops to about 0.65, the batter should be dry enough to be flipped and the screen to be removed. Doing so will further facilitate drying of the batter. (11) Continue to measure and record the water activity of the drying batter every 12 hours. Record the time at which the water activity of the drying batter drops below 0.60. Continue to dehydrate the drying batter until its water activity has been reduced below 0.45. (12) After the batter has been dehydrated to a water activity of 0.45, prepare a 2:1 slurry from two ounces of water and one ounce of the dried batter. Since each of the 2:1 slurries made from the original batter prior to dehydrating it, had different percentages of carbonated water (which is acidic) in them, the 2:1 slurries made from the dehydrated batters should have the same percentages of carbonated water in them so that the pH readings of these 2:1 slurries will properly correspond.

Detailed Description Text (106):
NOTE: This method calls for measuring the water activity of the drying batter every 12 hours in order to demonstrate that its water activity has been reduced below 0.60 before the 48th hour of dehydration has elapsed. Therefore, the cracker batter should only be made at a time when it will be convenient to measure its water activity every 12 hours thereafter. (1) Sprout 14.994 ounces of millet seeds until their weight is 22.05 ounces (about 26 hours) and 14.938 ounces of wheat seeds until their weight is 26.5 ounces (about 18 hours) by the method described in .sctn.5.3.1. (If 22.05 ounces of millet sprouts were dehydrated, the result would be 14 ounces of dried millet sprouts. If 26.5 ounces of wheat sprouts were dehydrated, the result would be 14 ounces of dried wheat sprouts.) (2) Ensure that the temperature of the atmosphere in the Preparation Room is between 90.degree. F. and 104.degree. F. Lower temperatures unduly lengthen drying time. Also use a dehumidifier to reduce the relative humidity of the atmosphere in the Preparation Room to less than 45% to speed up the drying of the sprout batter and to reduce the possibility of fungal growths while the sprouts are drying. (3) Dilute 11.45 ounces of carbonated distilled water with distilled water until its pH value is 4.0. (4) Place 1/3 of the millet sprouts (7.35 ounces) and 1/3 of the wheat sprouts (8.833 ounces) in the bowl of the Panasonic Food Processor set up with the knife blade attachment. Add 2.483 ounces of the diluted carbonated distilled water from step 3. Press the ON button of the food processor, and set the variable slide control lever to HIGH. Let the food processor run for 10 minutes, stopping occasionally to manually push the sprouts below the level of the knife blade in the bowl of the food processor. (After 10 minutes of liquefying, there should be no discernible sprout pieces; if sprout pieces can still be seen, continue liquefying until such pieces can no longer be seen.) Pour the liquefied sprout mixture from the bowl of the food processor into a suitably sized round glass, stainless steel, or plastic container (the mixing container) which complies with FDA regulations. (5) Process the other two thirds of the sprouts in the same way (each time adding 2.483 ounces of the diluted carbonated distilled water to the sprouts in the bowl of the food processor). (The water of this step which is added to the sprouts prior to liquefying them provides sufficient lubrication as the sprouts are being liquefied so that the sprouts will not overheat, and there is no need to monitor temperature.) The sprout solids to water ratio (SS/H20) here is 28/((22.05-14)+(26.5-14)+3*2.483)=28/28=1.000. (6) Pour the unused carbonated distilled water into a separate open container; its pH value will be measured at step 9 of this section. (7) Stir 28 ounces of whole hulled and preferably soaked and dried sesame seeds into the liquefied sprouts in the mixing container. Heat the mixture in the mixing container to a temperature of 104.degree. F.. Heating the batter to a temperature of 104.degree. F. before pouring it onto the dehydrator trays leads to a shorter dehydration time for the product batter thus giving fermentative organisms less time for their souring activity, thus yielding a better tasting product with a

significantly smaller .delta.pH.sub.LA. (The total weight of this mixture is 84 ounces=5 pounds 4 ounces.) (8) The batter for the Cheesy Variety consists of 14 ounces of millet sprout solids, 14 ounces of wheat sprout solids, 8.05 ounces of water contributed by the millet sprouts, 12.5 ounces of water contributed by the wheat sprouts, 28 ounces of sesame seeds, and 7.45 ounces of added carbonated water. Thus, the total solids is 56 ounces and the total water is 28 ounces. (Thus the batter is two-thirds solids and one-third water of which 26.61% is carbonated distilled water.) Remove 2.5 ounces of batter. Determine the pH value of a 2:1 slurry of this batter as follows: 2.5 ounces of this batter consists of 0.833 ounces of sprout solids, 0.833 ounces sesame seeds, 0.6116 ounces of water inherent in the sprouts, and 0.2217 ounces added carbonated water. In other words, this batter consists of 1.667 ounces of solids and 0.833 ounces of water. Add 2.5 ounces of distilled water to the 2.5 ounces of batter to make a 2:1 slurry, and stir well. Its composition, is now 3.333 ounces water and 1.667 ounces of solids. Measure the pH value of this 2:1 slurry. It should be about 6.0. Call the measured pH of this 2:1 slurry pH.sub.o. (9) Now measure the pH value of the unused portion of diluted carbonated distilled water set aside at step 6. The carbonated distilled water to be used at step 12 of .sctn.5.5.4.3 should first be diluted with distilled water until it has the same pH value as the unused portion whose pH value was just measured in this step. (10) At this point, proceed to .sctn.5.5.4.3, "Dehydrating the Batter".

Detailed Description Text (108):
NOTE: This method calls for measuring the water activity of the drying batter every 12 hours in order to demonstrate that the water activity of the drying batter has been reduced below 0.60 before about the 48th hour of dehydration has elapsed. Therefore, the cracker batter should only be made at a time when it will be convenient to measure its water activity every 12 hours thereafter. (1) Sprout 30 ounces of millet seeds until their weight is 44.1 ounces (about 26 hours) by the method described in .sctn.5.3.1. (2) At this point, ensure that the temperature of the atmosphere in the Preparation Room is between 90.degree. F. and 104.degree. F. Lower temperatures unduly lengthen drying time. Also use a dehumidifier to reduce the relative humidity of the atmosphere in the Preparation Room to less than 45% to speed up the drying of the sprouts and to reduce the possibility of fungal growths while the sprouts are drying. (3) Place 1/3 of the millet sprouts (14.7 ounces) and 5.367 ounces of honey in the bowl of the Panasonic Food Processor set up with the knife blade attachment. Press the ON button of the food processor, and set the variable slide control lever to HIGH. Let the food processor run for 10 minutes, stopping occasionally to manually push the sprouts below the level of the knife blade in the bowl of the food processor. (After 5 minutes of liquefying, there should be no discernible sprout pieces; if sprout pieces can still be seen, continue liquefying until such pieces can no longer be seen.) Empty the liquefied sprout mixture in the bowl of the food processor into a half gallon capacity glass, stainless steel, or plastic container (the mixing container) which complies with FDA regulations. (4) Process the other two thirds of the millet sprouts in the same way (each time adding 5.367 ounces of honey to the sprouts in the food processor bowl). (The honey of this step which is added to the sprouts prior to liquefying them provides sufficient lubrication as the sprouts are being liquefied so that the sprouts will not overheat, and there is no need to monitor temperature.) The sprout solids to water ratio (SS/H2O) here is 28/((44.1-28)+0.12*3*5.367)=1.553. (5) While stirring vigorously in a circular motion, slowly pour 28 ounces of whole hulled and preferably soaked and dried sesame seeds into liquefied sprouts in the mixing container near its inside wall, and continue to stir vigorously for several minutes more to ensure that the sesame seeds are uniformly distributed or dispersed throughout the batter. (The total weight of this mixture is 88.2 ounces=5 pounds 8.2 ounces.) Heat this batter to 104.degree. F. (6) The batter for Honey-Sweet Liquefied Sprouts Based NP CLASS Crackers consists of 28 ounces millet sprout solids, 14.168 ounces honey solids, 16.1 ounces of water contributed by the sprouts, 1.932 ounces of water contributed by the honey, and 28 ounces of sesame seeds. Thus, the total solids is 70.168 ounces and the total water is 18.032

ounces. (Thus the batter is 79.555% solids and 20.444% water of which 0% is carbonated distilled water, since none was added.) Remove 2.0 ounces of batter. Determine the pH value of a 2:1 slurry of this batter as follows: 2.0 ounces of this batter consists of 0.635 ounces sprout solids, 0.635 ounces sesame seeds, 0.365 ounces of water inherent in the sprouts, and 0.365 ounces of sage honey. Since sage honey is 12% water, the 0.365 ounces of honey contributes 0.0438 ounces of water and 0.32 ounces of honey solids to the 2.0 ounces of cracker batter. Or, in other words, the 2.0 ounces of cracker batter consists of 1.59 ounces of solids and 0.41 ounces water. Add 2.77 ounces of distilled water to the 2.0 ounces of batter to make a 2:1 slurry, and stir well. Its composition, is now 3.18 ounces of water and 1.59 ounces of solids. Measure the pH value of this 2:1 slurry. It should be about 5.8. Call this measured value pH.sub.o. (7) At this point, proceed to .sctn.5.5.4.3, "Dehydrating the Batter".

Detailed Description Text (109):
5.5.6 Detailed View of the Preferred Method for Making the Preferred Species, Sprout Flour Based NP CLASS Crackers Wherein the Pieces of Absorbent Vegetal Matter are Dehydrated Diced Carrots (1) Wash, scrub, and remove bad spots from fresh raw carrots. (2) Dice three pounds 14 ounces of carrots into cubes which are no longer than about three-sixteenths of an inch along each edge. (3) Ensure that the temperature of the atmosphere in the Preparation Room is between 90.degree. F. and 104.degree. F. Lower temperatures unduly lengthen drying time. Also use a dehumidifier to reduce the relative humidity of the atmosphere in the Preparation Room to less than 45% to speed up the drying of the carrots and later the sprout batter and to reduce the possibility of fungal growths while the sprout batter is drying. (4) Dehydrate the diced carrots until their water activity is less than 0.45. The three pounds 14 ounces of carrots will dehydrate to about 7 ounces.

Detailed Description Text (111):
(Hence, these crackers will be 20 percent by weight dehydrated carrots.) (8) Mill the millet sprouts and the wheat sprouts. (9) Pour 2 pounds 8.5 ounces carbonated distilled water into a suitably sized round stainless steel or plastic container (the mixing container) which complies with FDA regulations. (10) Stir the sprout flour made at Step 8 into the container of Step 9. Continue stirring until all the sprout flour is thoroughly wet. The result at this point should be a somewhat easy to stir sprout mixture. (11) While stirring vigorously in a circular motion, slowly pour the dehydrated carrot cubes into the mixing container near its inside wall, and continue to stir vigorously for several minutes more to ensure that the carrot cubes are uniformly distributed throughout the batter. (12) Place an 18 by 18 inch sheet of white paper on a flat surface. Place a screen-form in the center of the white sheet of paper. Place a 1/4th inch thick flat sheet of transparent lead-free glass or FDA approved plastic over the pieces of paper. The outline of the black screen-form can now be seen through the glass or plastic sheet. (13) Record the time. Pour a suitable amount of batter on the glass or plastic transparent sheet just over the place where the screen-form can be seen through the transparent sheet. Spread the batter smoothly to a uniform thickness within the outer circumference of the screen-form as seen through the transparent sheet. Contour the batter to the shape of this screen-form. Form a hole in the middle of the batter the same size as the central hole as seen through the transparent sheet. (14) As the batter rests on the transparent sheet, the dehydrated carrot pieces in the batter gradually absorb liquid from the batter making the batter firmer and sturdier. Eventually a point in time is reached where the batter is sufficiently sturdy that it can be sliced and lifted off of the transparent sheet without breaking apart. Therefore, let the batter on the transparent sheet set until it is firm enough to be sliced and lifted off the transparent sheet with a spatula without breaking. This time should be no longer than about 20 minutes (from the time recorded at step 13). (15) Slice the batter lengthwise into long slices (no more than about 2 inches wide). Measure the length of the blade of the spatula to be used at step 16 to lift the slices of batter off of the transparent sheet, and slice the batter crosswise into pieces of that length. (16) Place a circular screen

in a dehydrator tray. Using a spatula, lift the slices of batter off the transparent drying sheet and place on the circular screen, so that the slices are parallel to one another with slight spaces between the individual slices (for ventilation purposes). Now, slice the 2 inch wide batter slices into 1/4 inch by 1/2 inch squares. (17) Place the dehydrator tray with its slices of batter onto the dehydrator base unit. Place a despoked tray above the dehydrator tray having the batter. Now place an empty dehydrator tray on the despoked dehydrator tray. (18) Place the insulated dehydrator cover on the top tray to minimize loss of heat during the dehydration process. Set the rotary temperature selection dial to indicate a temperature of 104.degree. F. (40.degree. C.). Turn on the dehydrator, and record the time. (It is preferred to use a dehydrator which has means for varying the velocity of air over the drying surfaces of the batter. This velocity varying means should be set to its highest feasible setting in order to minimize dehydration time. The dehydrator which applicant used does not have means for raising the air velocity above its preset level.) (19) Thirty minutes after the completion of step 18, and every 30 minutes thereafter for the next 3 hours, reslice the drying batter along the slice marks of steps 15 and 16, and put the tray back on the dehydrator base unit. Replace the insulated dehydrator cover. (20) Twelve hours after the time recorded in Step 13 and every 12 hours thereafter, remove 2 ounces of the drying batter, and measure and record its water activity. When the water activity of the drying batter drops to about 0.65, the batter should be dry enough to be flipped and the screen to be removed. Doing so will further facilitate drying of the batter. (21) Continue to measure and record the water activity of the drying batter every 12 hours. Continue to dehydrate the drying batter until its water activity has been reduced below 0.45. (22) Package the product and refrigerate until ready to be used.

Detailed Description Text (116):
Method of Making NP CLASS Crackers: (1) Process 4 pounds 8.8 ounces of ripe pitted olives as follows: (a) Carefully inspect olives for pits and pit remnants removing the same when found. (b) Shred black pitted olives using the Presto Salad Shooter. Refrigerate shredded olives. (2) Wash, scrub, and remove bad spots from fresh raw carrots. Dice two pounds 1.25 ounces of carrots into cubes which are no longer than about three-sixteenths of an inch along each edge. (3) Ensure that the temperature of the atmosphere in the Preparation Room is between 90.degree. F. and 104.degree. F. Lower temperatures unduly lengthen drying time. Also use a dehumidifier to reduce the relative humidity of the atmosphere in the Preparation Room to less than 45% to speed up the drying of the carrot and olive pieces and later the sprout batter and to reduce the possibility of fungal growths while the sprout batter is drying. (4) Dehydrate the diced carrots and shredded olives until their water activity is less than 0.45. The two pounds 1.25 ounces of carrots will dehydrate to about 33/4 ounces. The four pounds 8.8 ounces of olives will dehydrate to about 14.5 ounces. (5) Measure out the proper amounts of the following ingredients: (a) 14 ounces dried millet sprouts (b) 14 ounces dried wheat sprouts (c) 3.5 ounces dehydrated carrot cubes (d) 14 ounces of dehydrated shredded olives (e) 1 pound 12 ounces of whole hulled sesame seeds (6) Mill the millet sprouts and the wheat sprouts. (7) Pour 3 pounds 12.5 ounces carbonated distilled water into a suitably sized round stainless steel or plastic container (the mixing container) which complies with FDA regulations. (8) Mix the dehydrated carrot and olive shreds with the sesame seed. Shake well in a closed container in order to form a substantially uniform mixture of carrot cubes, olive shreds, and sesame seeds. (9) Stir the sprout flour made at Step 6 into the container of Step 7. Continue stirring until all the sprout flour is thoroughly wet. The result at this point should be a somewhat easy to stir sprout mixture. (10) While stirring vigorously in a circular motion, slowly pour the carrot-olive-sesame seed mixture into the mixing container near its inside wall, and continue to stir vigorously for several minutes more to ensure that the carrot cubes, olive shreds, and sesame seeds are uniformly distributed throughout the batter. (11) Place an 18 by 18 inch sheet of white paper on a flat surface. Place a screen-form in the center of the white sheet of paper. Place a 1/4th inch thick flat sheet of transparent lead-free glass or FDA approved

plastic over the pieces of paper. The outline of the black screen-form can now be seen through the glass or plastic sheet. (12) Record the time. Pour a suitable amount of batter on the glass or plastic transparent sheet just over the place where the screen-form can be seen through the transparent sheet. Spread the batter smoothly to a uniform thickness within the outer circumference of the screen-form as seen through the transparent sheet. Contour the batter to the shape of this screen-form. Form a hole in the middle of the batter the same size as the central hole as seen through the transparent sheet. (13) Repeat steps 11 and 12 until all the batter has been so spread. (14) As the batter rests on the transparent sheet, the dehydrated carrot cubes, olive shreds, and sesame seeds in the batter gradually absorb liquid from the batter making the batter firmer and sturdier. Eventually a point in time is reached where the batter is sufficiently sturdy that it can be sliced and lifted off of the transparent sheet without breaking apart. Therefore, let the batter on the transparent sheet set until it is firm enough to be sliced and lifted off the transparent sheet with a spatula without breaking. This time should be no longer than about 20 minutes (from the time recorded at step 12). (15) Slice the batter lengthwise into long slices (no more than about 2 inches wide). Measure the length of the blade of the spatula to be used at step 16 to lift the slices of batter off of the transparent sheet, and slice the batter crosswise into pieces of that length. (16) Place a circular screen in a dehydrator tray. Using a spatula, lift the slices of batter off the transparent drying sheet and place on the circular screen, so that the slices are parallel to one another with slight spaces between the individual slices (for ventilation purposes). Now, slice the 2 inch wide batter slices into 1/4 inch by 1/2 inch squares. (17) Place the dehydrator tray with its slices of batter onto the dehydrator base unit. Place a despoked tray above the dehydrator tray having the batter. Now place an empty dehydrator tray on the despoked dehydrator tray. (18) Place the insulated dehydrator cover on the top tray to minimize loss of heat during the dehydration process. Set the rotary temperature selection dial to indicate a temperature of 104.degree. F. (40.degree. C). Turn on the dehydrator, and record the time. (It is preferred to use a dehydrator which has means for varying the velocity of air over the drying surfaces of the batter. This velocity varying means should be set to its highest feasible setting in order to minimize dehydration time. The dehydrator which applicant used does not have means for raising the air velocity above its preset level.) (19) Thirty minutes after the completion of step 18, and every 30 minutes thereafter for the next 3 hours, reslice the drying batter along the slice marks of steps 15 and 16, and put the tray back on the dehydrator base unit. Replace the insulated dehydrator cover. (20) Twelve hours after the time recorded in Step 12 and every 12 hours thereafter, remove 2 ounces of the drying batter, and measure and record its water activity. When the water activity of the drying batter drops to about 0.65, the batter should be dry enough to be flipped and the screen to be removed. Doing so will further facilitate drying of the batter. (21) Continue to measure and record the water activity of the drying batter every 12 hours. Continue to dehydrate the drying batter until its water activity has been reduced below 0.45. (22) Package the product and refrigerate until ready to be used.

Detailed Description Text (121):
One time as an experiment, I decided to try to make sesame coated compressed wheat sprouts. Using a strainer, I dipped compressed wheat sprouts in a solution of honey, apple concentrate, and water. I then let the compressed wheat sprouts drain and mixed them with sesame seed. Then I placed this mixture on circular screens in dehydrator trays, placed the dehydrator trays on the dehydrator base unit, and started dehydrating this mixture. Later that day, I had to leave the house, and went to check on how the sprouts were drying. It was then that I made the sad discovery that I had inadvertently set the temperature selector of the dehydrator at its very lowest setting (about 85.degree. F.) when I began dehydrating the sprouts, and, consequently, the compressed sprouts were still somewhat damp. Since I did not want the compressed wheat sprouts to over-dehydrate, I placed the dehydrator trays in the refrigerator which happens to be a frost-free model, intending to continue the dehydration process when I returned. Coming back about

ten hours later, I found that the compressed wheat sprouts had formed a firm crisp solid layer in each tray, and I had no difficulty peeling off the circular drying screens, which left me with firm crisp circular layers of compressed wheat sprouts and sesame seed interspersed. The product held together well and looked like it would make an excellent snack food.

Detailed Description Text (122):
Later, in reflecting on this new product, it occurred to me that while the reduced temperature and humidity of the frost-free refrigerator were inhibiting the growth of micro-organisms, the dehumidifying effect of the frost-free refrigerator was gradually lowering the water activity of the product below the lowest water activity at which such microbial growth could still occur. This being the case, products which are dried in a frost-free refrigerator need neither cooking nor preservative to inhibit microbial activity. And since the temperature in the refrigerator is above freezing, the valuable vitamin E in the product would not be damaged.

Detailed Description Text (135):
The first step in sprouting grain is to soak the selected grain for between five and ten hours in either filtered or distilled water at a temperature below 45.degree. C. (Higher temperatures would destroy the grain's ability to sprout.) In general, this temperature is between 20.degree. and 30.degree. C. (The optimal soak times for many seeds can be found on pages 72-73 of The UNcook Book by Elizabeth and Dr. Elton Baker (Communication Creativity, Saguache, Colo. (1980)). Next, the selected grains are either dehydrated immediately (The Quick Sprouting Method) or sprouted for at least 18 hours in an environment whose temperature is between 15.degree. and 30.degree. C. (The Traditional Sprouting Method). (It should be noted that during the first few hours of any subsequent dehydration, the grain sprouts still retain sufficient moisture to continue growing which brings about a further increase in enzymes, especially alpha amylase, and a further decrease in enzyme inhibitors.) If some grains such as wheat, however, are sprouted for much longer than 24 hours, they begin to develop an objectionable sweet taste. Many grains if they are sprouted for longer than about 24 hours, due to the lengthening of their roots and shoots, tend to become tangled which makes it difficult to feed them into the hopper of the Rolled Oats Crusher roller mill. Both the Traditional and Quick Sprouting Methods yield compressed hydrated grains. The terms "compressed sprouts" and "compressed dried sprouts" are to be understood as meaning "compressed hydrated grains" and "dried compressed hydrated grains" respectively wherever they appear in this specification.

Detailed Description Text (138):
If the Traditional Sprouting Method is being used, proceed to Step 7. And, in that event, please note that Step 8 should be performed six hours after step 6. If the Quick Sprouting Method is being used, perform steps (a) through (e) before proceeding to step 24 in the "Unflavored Compressed Sprouts by the Dehydration and Compression Method" section of this Specification. (a) Place a circular screen in a circular food dehydrator tray of the Model FD-1000 Food Dehydrator. You will notice that the screen has two semi-circular cutouts on opposite edges of the screen to enable one to more easily lift the screen out of the tray. When grain is spread on the screen, some of the grain close to these cutouts may fall through. To remedy this situation, place a second screen in the tray so as to cover the cutouts of the first screen, thus preventing the grain from falling through. (b) Place the dehydrator tray containing the two screens on a suitably sized pizza platter. (c) Spread 2 pints of the soaked grain evenly over the surface of the upper circular screen in the dehydrator tray. (d) Repeat steps (a) through (c), placing each newly prepared dehydrator tray on top of the last dehydrator tray (thus forming a stack of dehydrator trays on the pizza platter), until all of the soaked grain has been placed in dehydrator trays. There is now a stack of dehydrator trays on the pizza platter. (e) Place the stack of dehydrator trays on the dehydrator base unit which contains the heater and fan. Put the insulated dehydrator cover on the top tray of

the stack of trays. (f) Now proceed to Step 24 in the "Unflavored Compressed Sprouts by the Dehydration and Compression Method" section of this Specification. (7) In an area where the temperature is between 15.degree. and 30.degree. C., set up a grain sprouter to sprout the soaked wheat grain as described in the "Setup of Equipment Used in Manufacture of Invention" section of this patent application. Please note, however, that the circular screens of Step (b) of that section are only suitable for grains larger than the hole openings of the screens. For sprouting smaller grains, suitable screen material may be obtained from Alfa III Corporation, Chaska, Minn. (The grain sprouter as set up should have ten trays of soaked wheat. The eleventh tray on top contains just the wet napkins.) (8) Six hours after performing step 6, fill a large stainless steel drum with enough water to cover the top tray of the grain sprouter set up in step 7 when it is submerged in the stainless steel drum. If you are using Freund Can Company's 16" Inside Diameter 20 gallon stainless steel drum, 91/2 gallons of water will be required to cover the top tray of the grain sprouter. It is very important that this water be either distilled or filtered water; the chemicals added to municipal water may retard the growth of the sprouts. (9) Remove the insulated dehydrator cover. Using a good quality butchers twine, tightly tie together the stack of trays from top to bottom such that it will hold together when you immerse this stack of trays in the water in the drum. (10) Using the portion of the butchers twine stretched across the top tray as a handle, slowly lower the stack of trays minus the insulated cover into the stainless steel drum until the top tray of the stack of trays is submerged. Wait 10 seconds while the sprouts soak. (11) Slowly raise the stack of trays from the drum of water, tip the stack of trays to facilitate drainage, allow to drain for 10 seconds or so, and place the stack of trays back in the stainless steel pan. Replace the insulated cover. (12) Six hours later, remove the dehydrator cover, and repeat steps 10 and 11. (13) Three hours later, remove the dehydrator cover, and again repeat steps 10 and 11. (14) Three hours later, remove the twine holding the stack of trays together, and remove the top tray which contains the napkins. (The sprouts have now been growing for a total of 18 hours since step 6.) (15) The next step is to make compressed sprouts. There are two methods for producing compressed sprouts. The first method is entitled the "Compression and Refrigeration Method". In this method, the sprouts are compressed with a roller mill and dried in a frost-free refrigerator until their water activity has fallen below 0.70. The second method is entitled the "Dehydration and Compression Method". In this method, the sprouts are dehydrated until their water activity has fallen below 0.91, compressed with a roller mill, and then further dehydrated until their water activity has fallen below 0.60. Each method has certain advantages.

Detailed Description Text (144):
Note: In order to eliminate the possibility of bacterial souring, steps 17 and 18 should be performed at a location where the temperature is between 40 and 45.degree. F. (4-7.degree. C.) and the relative humidity is less than 45%. (17) Fill the hopper of the Rolled Oats Crusher roller mill with sprouts from the stainless steel basin, and turn the handle of the roller mill until the sprouts have fed through. Repeat until all of the sprouts have fed through, stopping occasionally to empty the tray beneath the rollers of the roller mill. Please note that these sprouts need not be treated with preservative either before or after this step inasmuch as bacterial souring and fungal growth will be inhibited by the cold and reduced humidity of the frost-free refrigerator at step 19. (Applicant has found that the rollers of the Rolled Oats Crusher roller mill are close enough together to compress sprouted wheat to less than its MMT.) (18) Place a dehydrator tray on a pizza platter and place a circular screen in the dehydrator tray. Evenly spread 2 pints of the compressed sprouts over the circular screen. Repeat this step until all the sprouts have been placed in trays and stacked on the pizza platter. There should now be 14 trays stacked on the pizza platter. Do not cover the top tray in any way. Place the pizza platter with its stack of trays in a frost-free refrigerator whose interior temperature is 40.degree. F. (4.degree. C.). (19) Leave the sprouts in the refrigerator until their water activity is less than 0.70 (36-40 hours). To speed the drying process the following can be done: a. The soak water

remaining on the sprouts will drip onto the pizza platter and, by evaporation, tend to raise the humidity in the refrigerator thus slowing the drying process. After one hour of drying, replace the pizza platter under the stack of trays with a dry pizza platter. b. A small fan can be placed in the refrigerator to improve circulation and facilitate drying. c. To further facilitate drying, place suitable plastic or wooden spacers or separators between the trays in order to separate the trays somewhat from one another.

Detailed Description Text (145):
As mentioned in the introduction to the "Description of Preferred Method to Manufacture Invention" section of this patent application, micro-organisms will grow at refrigerator temperature if the relative humidity inside the refrigerator exceeds 85 percent. Therefore it is wise to monitor relative humidity within the refrigerator while the sprouts are drying, making sure that it never climbs this high.

Detailed Description Text (146):
If crisper compressed sprouts are desired perform step 20; otherwise go to step 21. (20) Mount the 14 trays of sprouts on the dehydrator base unit. Pour the 4 ounce jar of sprouts which was placed in the refrigerator at step 16 into a separate tray, and place it on top of the other trays. Replace the insulated cover, and set the dehydrator temperature to 104.degree. F. (400 C), and dehydrate the sprouts until the desired degree of crispness is obtained. (It is recommended that the sprouts be dehydrated until their water activity is less than 0.60.) (21) Record the weight of the product obtained. Set aside 4 ounces of these compressed dried sprouts and also the 4 ounces of uncompressed sprouts placed in the refrigerator at step 16 for the pH measurement to be performed at step 75. At this point proceed to step 33.

Detailed Description Text (148):
The following steps teach the method for making unflavored compressed sprouts by the dehydration and compression method. (22) Make sure that the sprouts are still spread evenly on each tray. If they are not spread evenly, clumps of sprouts will still be moist on the inside after the sprouts surrounding them have dried. (23) Place the stack of dehydrator trays (minus the top tray which contained the wet napkins) on the dehydrator base unit which contains the heater and fan. Put the insulated cover back on top of the stack of trays. (24) Using the rotary temperature selection dial of the dehydrator, select a temperature of 104.degree. F. (40.degree. C.), turn on dehydrator power, and dehydrate the sprouts until their water activity has been reduced below 0.91. (It is preferred to use a dehydrator which has means for varying the velocity of air over the drying sprouts. This velocity varying means should be set to its highest feasible setting in order to minimize dehydration time. The dehydrator which applicant used does not have means for raising the air velocity above its preset level.) Drying time will depend on the temperature and relative humidity in the room in which drying is done.

Detailed Description Text (149):
At a temperature of 104.degree. F. (40.degree. C.), most of the enzymes of the sprouts should be retained in the final product, inasmuch as temperatures below 118.degree. F. (48.degree. C.) do not destroy enzymes under normal conditions. One key test for preservation of enzyme activity is the test for diastatic or amylase activity. If a product during the course of processing has retained most of its amylase activity, it most likely has retained other enzyme activity as well. Most of the enzyme activity in growing sprouts is diastatic activity which converts starches to sugars. Furthermore, the temperature of 104.degree. F. (40.degree. C.) is well below 161.degree. F. (72.degree. C.), the temperature at which proteins begin to be denatured (to have their natural qualities and characteristics undergo change for the worse). Another key test is the determination of the product's DV, the Percentage Destruction of Viability Due to Heat, and DG, the Percentage Decrease in Growth Potential Due to Heat. Please see the "Verification of Product

Vitality" section following step 75 for a discussion of this second key test. (25) When the sprouts have dried to a water activity of 0.90, empty the trays into an 181/2" diameter stainless steel basin. (26) Set aside 4 ounces of these dried sprouts for the pH measurement to be performed at step 75. (27) Fill the hopper of the Rolled Oats Crusher roller mill with these dehydrated sprouts, and turn the handle of the roller mill until the sprouts have fed through. Repeat until all of the sprouts have fed through, stopping occasionally to empty the tray beneath the rollers of the roller mill. Please note that the dehydrated sprouts need not be treated with a preservative either before or after this step inasmuch as their water activity was reduced below the point at which bacterial souring can occur at step 25 above. (Applicant has found that the rollers of the Rolled Oats Crusher roller mill are close enough together to produce compress sprouted grain with an MD of less than 1.) (28) Place a circular screen in a dehydrator tray and evenly spread 11/2 pints of the compressed dehydrated sprouts over the circular screen. Place the tray on the circular base unit of the dehydrator. Repeat this step until all of the compressed dehydrated sprouts have been placed in trays on the circular base unit. There should now be 12 or 13 trays stacked on the dehydrator's circular base. (29) Place the insulated dehydrator cover on the top dehydrator tray. (30) Set the rotary selection dial of the dehydrator to 104.degree. F. (40.degree. C.), and dehydrate the sprouts until the water activity of the sprouts is reduced below 0.60. If crisper compressed sprouts are desired perform step 31; otherwise go to step 32. (31) Further dehydrate the sprouts until the desired degree of crispness is obtained. (32) Record the weight of the product obtained. Set aside 4 ounces of these compressed dried sprouts for the pH measurement to be performed at step 75. (33) Transfer the sprouts into covered storage containers and refrigerate until ready to be used. As long as the dried sprouts are adequately refrigerated, they should keep for a year or more with little, if any, deterioration.

Detailed Description Text (153):
Note: In order to eliminate the possibility of bacterial souring, steps 35 through 37 should be performed at a location where the temperature is between 40 and 45.degree. F. (4-7.degree. C.) and the relative humidity is less than 45%. In addition, set the temperature of the refrigerator to be used at step 39 to 40.degree. F. (4.degree. C.). (35) In a bowl of suitable size, thoroughly mix together the following ingredients: (a) 1 pint of cold (40.degree. F.) neutral pH water (b) 4 ounces of cold (40.degree. F.) apple concentrate

Detailed Description Text (154):
In order that the results obtained will be comparable to the results given at step 75, apple concentrate with a pH of 3.9 should be used. Please note that there is no need to include a preservative with the above ingredients inasmuch as bacterial souring and fungal growth will be inhibited by the cold and reduced humidity of the frost-free refrigerator at step 39. (36) Fill a small strainer with some of the compressed sprouts from step 34, dip the strainer into the bowl of step 35 until the sprouts therein are covered with the mixture of step 35 (stirring if necessary). Then raise the strainer, allow the mixture to drain from the sprouts for about five seconds, and pour the sprouts into a larger bowl. Repeat this step until 2 pounds of sprouts have been so treated. (37) Weigh these sprouts in order to determine how much of the mixture of step 35 they have on them. Record this weight in ounces. From this weighing, compute the number of ounces of apple concentrate on the product to be set aside at step 42 as follows: (all amounts are expressed in ounces) Apple Concentrate on Sprouts (oz.)=0.2*(Weight of Sprouts-32) Apple Concentrate on 1/16th of product to be set aside at Step 42=(Apple Concentrate on Sprouts)/16 (38) Place a dehydrator tray on a pizza platter and place a circular screen in the dehydrator tray. Evenly spread 1 pint of the compressed sprouts over the circular screen. Repeat this step until all the sprouts have been placed in trays and stacked on the pizza platter. There should now be 4 trays stacked on the pizza platter. Do not cover the top tray in any way. (39) Place the pizza platter with its stack of trays in a frost-free refrigerator whose interior temperature is 40.degree. F. (4.degree. C.) (40) Leave the sprouts in the

refrigerator until the water activity of the sprouts is less than 0.70 (36-40 hours). To speed the drying process the following can be done: a. The mixture covering the sprouts will drip onto the pizza platter and, by evaporation, tend to raise the humidity in the refrigerator thus slowing the drying process. Every hour or so for the first few hours of drying and every 6 hours thereafter, replace the pizza platter under the stack of trays with a dry pizza platter. b. A small fan can be placed in the refrigerator to improve circulation and facilitate drying. c. To further facilitate drying, place suitable plastic or wooden spacers or separators between the trays in order to separate the trays somewhat from one another.

Detailed Description Text (155):
As mentioned in the introduction to the "Description of Preferred Method to Manufacture Invention" section of this patent application, micro-organisms will grow at refrigerator temperature if the relative humidity inside the refrigerator exceeds 85 percent. Therefore it is wise to monitor relative humidity within the refrigerator while the sprouts are drying, making sure that it never climbs this high. It is now recommended that the compressed sprouts be dehydrated until their water activity is less than 0.60. If it is desired to do this, mount the 4 trays of sprouts on the dehydrator base unit, set dehydrator temperature to 104.degree. F. (40.degree. C.), and dehydrate the sprouts until the desired degree of crispness is obtained. (Please note that if the dehydrator is used before water activity has been reduced below 0.75, microbial growth may occur, thus ruining the taste of the product.) (It is preferred to use a dehydrator which has means for varying the velocity of air over the drying sprouts. This velocity varying means should be set to its highest feasible setting in order to minimize dehydration time. The dehydrator which applicant used does not have means for raising the air velocity above its preset level.) (41) Pour these sprouts into a large stainless steel basin. (42) Record the weight of these sprouts, and set aside 1/16th of these sprouts for the pH measurement to be performed at step 75. Package the rest of the dried compressed sprouts and refrigerate until ready to be used.

Detailed Description Text (159):
Note: In order to eliminate the possibility of bacterial souring, steps 44 through 46 should be performed at a location where the temperature is between 40 and 45.degree. F. (4-7.degree. C.) and the relative humidity is less than 45%.

Detailed Description Text (160):
(44) In a bowl of suitable size, thoroughly mix together the following ingredients: (a) cup of cold (40.degree. F.) neutral pH water (b) 2 pounds of cold (40-45.degree. F.) honey (45) Fill a small strainer with some of the compressed sprouts from step 43, dip the strainer into the bowl of step 44 until the sprouts therein are covered with the mixture of step 44 (stirring if necessary). Then raise the strainer, allow the mixture to drain from the sprouts for about five seconds, and pour the sprouts into a larger bowl. Repeat this step until 21/2 pounds of sprouts have been so treated. Weigh these sprouts in order to determine how much of the mixture of step 44 they have on them. Record this weight in ounces. From this weighing, compute the number of ounces of honey on the product to be set aside at step 50 as follows: (all amounts are in ounces) Honey on Sprouts (oz.)=0.8*(Weight of Sprouts-40) Honey on 1/20th of product set aside at step 40=(Honey on Sprouts)/20 (46) Place a dehydrator tray on a pizza platter and place a circular screen in the dehydrator tray. Evenly spread 21/2 pints of the compressed sprouts from step 45 over the circular screen. Place a circular screen on top of the compressed sprouts in the dehydrator tray, and evenly apply pressure on all parts of this circular screen to form a compacted layer of sprouts in the dehydrator tray. Remove this circular screen. Repeat this step until all the sprouts have been placed in trays and stacked on the pizza platter. There should now be 2 trays stacked on the pizza platter. Place the pizza platter with its stack of trays in a frost-free refrigerator whose interior temperature is 40.degree. F. (4.degree. C.). Do not cover the top dehydrator tray in any way. (47) Allow the trays of compressed sprouts to dry in the refrigerator until the water activity of the compressed

sprouts is reduced to below 0.70. To speed the drying process, the following can be done: a. Slice the drying layers of compressed sprouts into half-inch squares. b. The mixture covering the sprouts will drip onto the pizza platter and, by evaporation, tend to raise the humidity in the refrigerator thus slowing the drying process. Every hour or so for the first few hours of drying and every 6 hours thereafter, replace the pizza platter under the stack of trays with a dry pizza platter. c. A small fan can be placed in the refrigerator to improve circulation and facilitate drying. d. To further facilitate drying, place suitable plastic or wooden spacers or separators between the trays in order to separate the trays somewhat from one another. (48) Now that the water activity of the sprouts has been reduced below 0.70, the dehydrator can be used to obtain the desired degree of crispness. (If the dehydrator is used before water activity has been reduced below 0.75, microbial growth may occur, thus ruining the taste of the product.) Remove the two dehydrator trays from the refrigerator and place them on the circular base unit of the food dehydrator. Place the circular insulated cover on the top tray, set the rotary temperature selection dial of the dehydrator to 104.degree. F. (40.degree. C.), and dehydrate the sprouts until the desired degree of crispness is obtained. (It is preferred to use a dehydrator which has means for varying the velocity of air over the drying sprouts. This velocity varying means should be set to its highest feasible setting in order to minimize dehydration time. The dehydrator which applicant used does not have means for raising the air velocity above its preset level.) (49) Place the two dehydrator trays back in the refrigerator and allow the products therein to chill until the honey in the layers of compressed sprouts has congealed, and the layers of compressed sprouts are firm to the touch. (50) Remove the 2 dehydrator trays from the refrigerator. Remove the solidified layer of compressed sprouts from each tray, and peel off the circular screen. Break these solidified layers of compressed sprouts into half inch squares along the slice marks made at Step 47, package them, and refrigerate until ready to be used. Record the weight of the product obtained. Set aside 1/20th of this product for the pH measurement to be performed at step 75.

Detailed Description Text (164):
CAUTION: In order to eliminate the possibility of bacterial souring, steps 53 through 55 should be performed at a location where the temperature is between 40 and 45.degree. F. (4-7.degree. C.), and the relative humidity is less than 45%. (53) In a bowl of suitable size, thoroughly mix together the following ingredients: (a) 4 cups of cold (40.degree. F.) neutral pH water (b) 1 pound of cold (40.degree. F.) milled sprouts (54) Stir in the compressed sprouts from step 51, until the sprouts are thoroughly covered with the mixture of step 53. (55) Place a dehydrator tray on a pizza platter, and place a circular screen in the dehydrator tray. Evenly spread 1 pint of the mixture-coated compressed sprouts over the circular screen. Place a circular screen on top of the compressed sprouts in the dehydrator tray, and evenly apply pressure on all parts of this circular screen to form a compacted layer of compressed sprouts in the dehydrator tray. Remove this circular screen. Repeat this step, stacking each tray, as it is completed, on the pizza platter until all the compressed sprouts have been placed in trays. There should now be 5 trays stacked on the pizza platter. (56) Place the pizza platter with its stack of trays in a frost-free refrigerator whose interior temperature is 40.degree. F. (4.degree. C.). Do not cover the top dehydrator tray in any way. (57) Allow the trays of compacted compressed sprouts to dry in the refrigerator until the water activity of the layers of compacted compressed sprouts has been reduced to below 0.70.

Detailed Description Text (165):
To speed the drying process, the following can be done: a. Slice the drying layers of compressed sprouts into half-inch squares. b. The mixture covering the sprouts will drip onto the pizza platter and, by evaporation, tend to raise the humidity in the refrigerator thus slowing the drying process. After the first hour of drying, replace the pizza platter under the stack of trays with a dry pizza platter. There should be no more dripping after this. c. A small fan can be placed in the

refrigerator to improve circulation and facilitate drying. d. To further facilitate drying, place suitable plastic or wooden spacers or separators between the trays in order to separate the trays somewhat from one another. (58) Now that the water activity of the sprouts has been reduced below 0.70, the dehydrator can be used to obtain the desired degree of crispness. (If the dehydrator is used before water activity has been reduced below 0.75, microbial growth may occur, thus ruining the taste of the product.) Remove the five dehydrator trays from the refrigerator and mount them on the circular base unit of the food dehydrator. Place the insulated dehydrator cover on the top tray. Set the rotary temperature selection dial of the dehydrator to 104.degree. F. (40.degree. C.), and dehydrate the compressed sprouts until the desired degree of crispness is obtained. (It is preferred to use a dehydrator which has means for varying the velocity of air over the drying surfaces of the compressed sprouts. This velocity varying means should be set to its highest feasible setting in order to minimize dehydration time. The dehydrator which applicant used does not have means for raising the air velocity above its preset level.) (59) Remove the solidified layer of compressed sprouts from each 1 tray, and peel off the circular screen. Record the weight of the product obtained. Break these solidified layers of compressed sprouts into half inch squares along the slice marks made at Step 57, package them, and refrigerate until ready to be used. Set aside 2 ounces of this product for the pH measurement to be performed at step 75.

Detailed Description Text (175):
In order to demonstrate that NP CLASS Crackers and RUSTIC Sprouted Seed Products have not been processed at such temperatures and times which would damage the vitality of my products, I present two methods for measuring the degree of damage a product has experienced due to excessive heat.

Detailed Description Text (176):
The first method measures DV, the Percentage Destruction of Viability Due to Heat. Essentially, DV is a measure of the degree to which the seeds in a product would fail to sprout due to thermal damage if they had been held in water prior to sprouting at the various temperatures and times of the process which produced the product.

Detailed Description Text (177):
The second method measures DG, the Percentage Decrease in Growth Potential Due to Heat. Essentially, DG is a measure of the degree to which the seeds in a product would have had their rate of growth decreased due to thermal damage if they had been held in water prior to sprouting at the various temperatures and times of the process which produced the product.

Detailed Description Text (179):
A. Computation of DV, the Percentage Destruction of Viability Due to Heat: (1) Compute the total time that a product is exposed to temperatures above 30.degree. C., i.e., somewhat above what is normally considered room temperature. (Temperatures below 30.degree. C. are not known to damage any of the known nutrients in food.) (2) Compute the average temperature, T.sub.av, during those periods when the product is exposed to such elevated temperatures. (3) Compute Elevated Temperature Soak Time, R.sub.e, as the lesser of: (a) Total time product was exposed to temperatures above 30.degree. C. (b) Eight hours. (4) Compute Room Temperature Soak Time: R.sub.o =8 hours-R.sub.e (5) Carefully select n.sub.t (n.sub.t.gtoreq.50) plump seeds which are not damaged, discolored, or shriveled. Soak these seeds in distilled water in a sealed thermally conductive container for R.sub.e hours at a temperature of T.sub.av. (The container is sealed to prevent evaporation and resultant cooling.) (6) At the end of R.sub.e hours, continue to soak the seeds for a further R.sub.o hours at a temperature of 20-30.degree. C. (i.e., room temperature). (7) Between the start of step 5 and the end of step 6, the seeds will have soaked for a total of 8 hours. (8) Soak a second lot of n.sub.t (same as the n.sub.t of step 5) seeds of the same kind in distilled water for eight

hours at 20-30.degree. C. (9) Sprout the seeds of step 7 for 48 hours. Let n.sub.e be the number of seeds out of n.sub.t which sprout. (10) Sprout the seeds of step 8 for 48 hours. Let n.sub.r be the number of seeds out of n.sub.t which sprout. (11) Compute DV for this product as follows:

Detailed Description Text (180):
(By definition, a product which was never subjected to a temperature greater than 30.degree. C. has a DV of 0 percent. One's diet should consist primarily of such foods.)

Detailed Description Text (181):
B. Computation of DG, the Percentage Decrease in Growth Potential Due to Heat: (1) Compute the total time that a product is exposed to temperatures above 30.degree. C. (2) Compute the average temperature, T.sub.av, during those periods when the product is exposed to such elevated temperatures. (3) Compute Elevated Temperature Soak Time, R.sub.e, as the lesser of: (a) Total time product was exposed to temperatures above 30.degree. C. (b) Eight hours. (4) Compute Room Temperature Soak Time, R.sub.o :

Detailed Description Text (182):
R.sub.o =8 hours-R.sub.e (5) Carefully select one pound of plump seeds which are not damaged, discolored, or shriveled. Soak this grain in distilled water in a sealed thermally conductive container for R.sub.e hours at a temperature of T.sub.av. (The container is sealed to prevent evaporation and resultant cooling.) (6) At the end of R.sub.e hours, continue to soak the seeds for a further R.sub.o hours at a temperature of 20-30.degree. C. (7) Between the start of step 5 and the end of step 6, the seeds will have soaked for a total of 8 hours. Weigh the seeds. Let W.sub.eo be the weight of these soaked seeds. (8) Soak another pound of similarly selected seeds for eight hours at 20-30.degree. C. Weigh these soaked seeds. Let W.sub.ro be the weight of these soaked seeds after 8 hours of soaking. (9) Sprout the seeds of step 7 for 48 hours. Let W.sub.e be the weight of these seeds after 48 hours. Compute .delta.W.sub.e, the weight gain of these seeds during the 48 hours of sprouting. (Thus .delta.W.sub.e does not include the weight of the water absorbed as a result of soaking for 8 hours.) .delta.W.sub.e =W.sub.e - W.sub.eo. (10) Sprout the seeds of step 8 for 48 hours. Let W.sub.r be the weight of these seeds after 48 hours. Compute .delta.W.sub.r, the weight gain of these seeds during the 48 hours of sprouting. (Thus .delta.W.sub.e does not include the weight of the water absorbed as a result of soaking for 8 hours.) .delta.W.sub.r =W.sub.r -W.sub.ro. (11) Compute DG for this product as follows:

Detailed Description Text (184):
(By definition, a product which was never subjected to a temperature greater than 30.degree. C. has a DG of 0 percent.)

Detailed Description Text (186):
In September of 1990, various samples of low temperature sprouted wheat products were submitted to Winston Laboratories, Inc., Ridgefield Park, N.J. for enzymatic analysis. Their October 8 letter gives the results of their analysis of some of Applicant's sprouted wheat products for alpha amylase enzymatic activity. Alpha amylase is the dominant enzyme in sprouting wheat. The first sample was wheat sprouts which were dehydrated just enough so that they could be sent via UPS to Winston Laboratories. A temperature of 104 F was used to dry these for only a few hours so that any loss of enzymatic activity would be minimal. These slightly dried sprouts should have essentially the same enzymatic activity as they had while they were still growing.

Detailed Description Text (213):
The values of DV, the Percentage Destruction of Viability Due to Heat, and DG, the Percentage Decrease in Growth Potential Due to Heat, of NP CLASS Crackers will now be compared with the corresponding values for a product whose process includes

dehydration at 125.degree. F. (52.degree. C.) for eight hours. It will be shown that if soaking seeds had been subjected to the times and temperatures which the sprouts in NP CLASS Crackers experienced during their production process, neither their viability nor their growth potential would have experienced significant damage, whereas if they had been subjected to the times and temperatures of products prepared at 125.degree. F. (52.degree. C.), they would have had both their viability and growth potential severely damaged.

Detailed Description Text (216):
The DV value for NP CLASS Crackers was computed as follows: (1) During their processing, NP CLASS Crackers were exposed to the temperature of 104.degree. F. (40.degree. C.) for periods of time in excess of 8 hours. (2) Therefore the average elevated temperature of exposure, T.sub.av, is 104.degree. F. (40.degree. C.). (3) Elevated Temperature Soak Time, R.sub.e, is 8 hours. (4) Room Temperature Soak Time, R.sub.o, was computed as follows:

Detailed Description Text (218):
The DV value of a product whose process included dehydration for 8 hours at 125.degree. F. (52.degree. C.) was computed as follows: (1) The average elevated temperature of exposure, T.sub.av, is 125.degree. F. (52.degree. C.) (2) Elevated Temperature Soak Time, R.sub.e, is 8 hours. (3) Room Temperature Soak Time, R.sub.o, was computed as follows:

Detailed Description Text (219):
Therefore, it can be concluded that a temperature of 125.degree. F. (52.degree. C.) for eight hours is injurious to the sprouting capability of wheat and millet grain whereas a temperature of 104.degree. F. (40.degree. C.) for 8 hours is but slightly injurious to the sprouting capability of these grains.

Detailed Description Text (223):
The DG value for NP CLASS Crackers was computed as follows: (1) The batter of NP CLASS crackers was exposed to a temperature of 104.degree. F. (40.degree. C.) for periods of time in excess of 8 hours. (2) Therefore the average elevated temperature of exposure, T.sub.av, is 104.degree. F. (40.degree. C.). (3) Elevated Temperature Soak Time, R.sub.e, is 8 hours. (4) Room Temperature Soak Time, R.sub.o,=8 hours-R.sub.e =0. (5) One pound each of wheat and millet were soaked in distilled water in a sealed thermally conductive container for 8 hours at a temperature of 104.degree. F. (6) After soaking for 8 hours, the wheat seeds weighed 1 pound 8.6 ounces. Thus W.sub.eo for the wheat=1.537 pounds. The millet seeds now weighed 1 pound 5.6 ounces. Thus W.sub.eo for the millet=1.35 pounds. (7) One pound each of wheat and millet were soaked in distilled water for 8 hours at a temperature of 30.degree. C. (8) After soaking for a total of 8 hours, the wheat seeds weighed 1 pound 7.4 ounces. Thus W.sub.ro for the wheat=1.462 pounds. The millet seeds now weighed 1 pound 6.1 ounces. Thus W.sub.ro for the millet=1.381 pounds. (9) The seeds of step 6 were sprouted for 48 hours. W.sub.e for the wheat sprouts, We.sub.wheat =2 pounds 4.5 ounces=2.281 pounds. We for the millet sprouts, We.sub.millet =1 pound 15.4 ounces=1.963 pounds. .delta.We.sub.wheat =We.sub.wheat -Weo.sub.wheat =0.744 pounds. .delta.We.sub.millet =We.sub.millet -Weo.sub.millet =0.613 pounds. .delta.We.sub.comb, the combined weight gain.of both wheat and millet sprouts,=.delta.We.sub.wheat +.delta.We.sub.millet =1.357 pounds. It should be noted that more than 95% of the wheat and millet seeds sprouted. (10) The seeds of step 8 were sprouted for 48 hours. Wr for the wheat sprouts, Wr.sub.wheat =2 pounds 6.9 ounces=2.431 pounds. Wr for the millet sprouts, Wr.sub.millet =2 pounds 2.5 ounces=2.156 pounds. .delta.Wr.sub.wheat =Wr.sub.wheat -Wro.sub.wheat =0.969 pounds. .delta.Wr.sub.millet =Wr.sub.millet -Wro.sub.millet =0.775 pounds. .delta.Wr.sub.comb, the combined weight gain of both wheat and millet sprouts,=.delta.Wr.sub.wheat +.delta.Wr.sub.millet =1.774. More than 95% of the wheat and millet seeds sprouted. (11) DG for this product was computed as follows:

Detailed Description Text (225):

The DG value of a product whose process included dehydration for 8 hours at 125.degree. F. (52.degree. C.) was computed as follows: (1) The average elevated temperature of exposure, T.sub.av, is 125.degree. F. (52.degree. C.) (2) Elevated Temperature Soak Time, R.sub.e, is 8 hours. (3) Room Temperature Soak Time, R.sub.o,=8 hours-R.sub.e =0. (4) One pound each of wheat and millet were soaked in distilled water in a sealed thermally conductive container for 8 hours at a temperature of 125.degree. F. (5) After soaking for a total of 8 hours, the wheat seeds weighed 1 pound 10.9 ounces. Thus W.sub.eo for the wheat=1.681 pounds. The millet seeds now weighed 1 pound 6.6 ounces. Thus W.sub.eo for the millet=1.412 pounds. (6) The seeds of step 5 were sprouted for 48 hours. We for the wheat sprouts, We.sub.wheat =1 pound 13.3 ounces=1.831 pounds. We for the millet sprouts, We.sub.millet =1 pound 7.4 ounces=1.462 pounds. .delta.We.sub.wheat =We.sub.wheat - Weo.sub.wheat =0.15 pounds. .delta.We.sub.millet =We.sub.millet -Weo.sub.millet =0.05 pounds. .delta.We.sub.comb, the combined weight gain of both wheat and millet sprouts,=.delta.We.sub.wheat +.delta.We.sub.millet =0.20 pounds. None of the wheat or millet seeds sprouted. The apparent gain in weight of the wheat and millet seeds over the 48 hour period is due to the wheat and millet seeds becoming more and more water-logged. (It should be noted that after 48 hours of attempting to sprout these seeds, both the wheat and millet seeds began to develop an offensive odor.) (7) From 5.9.2.5.2A step (10), W.sub.r for the wheat sprouts is 2.431 pounds. Likewise, W.sub.r for the millet sprouts is 2.156 pounds. (8) DG for this product was computed as follows:

Detailed Description Text (227):
Again, it can be concluded that a temperature of 125.degree. F. (52.degree. C.) for eight hours is injurious to the sprouting capability of wheat and millet grain whereas a temperature of 104.degree. F. (40.degree. C.) for 8 hours is only slightly injurious to the sprouting capability of those grains.

Detailed Description Text (275):
Using the seed sprouter described in the .sctn.5.3.1, Construction and Use of a Seed Sprouter to Sprout Seeds", ten pounds of wheat grain were sprouted for 18 hours. The sprouts were then dehydrated for 10 hours at a temperature of 104.degree. F. After 10 hours of dehydration, the water activity of the sprouts was about 0.9. In order that one may more easily correlate the results I obtained for this example with the steps of my method, the steps that had measurable outputs and the results obtained for those steps are shown below:

Detailed Description Text (279):
The values of DV, the Percentage Destruction of Viability Due to Heat, and DG, the Percentage Decrease in Growth Potential Due to Heat, of RUSTIC Sprouted Grain Products will now be compared with the corresponding values for a product whose process includes dehydration at 125.degree. F. (52.degree. C.) for eight hours. It will be shown that if soaking seeds had been subjected to the times and temperatures which the sprouts in RUSTIC Sprouted Grain Products experienced during their production process, neither their viability nor their growth potential would have experienced significant damage, whereas if they had been subjected to the times and temperatures of products prepared at 1250 F (52.degree. C.), they would have had both their viability and growth potential severely damaged.

Detailed Description Text (282):
The DV value for RUSTIC Sprouted Grain Products was computed as follows: (1) During their processing, RUSTIC Sprouted Grain Products were exposed to the temperature of 104.degree. F. (40.degree. C.) for periods of time in excess of 8 hours. (2) Therefore the average elevated temperature of exposure, T.sub.av, is 104.degree. F. (40.degree. C.). (3) Elevated Temperature Soak Time, R.sub.e, is 8 hours. (4) Room Temperature Soak Time, R.sub.o, was computed as follows:

Detailed Description Text (284):
The DV value of a product whose process included dehydration for 8 hours at

125.degree. F. (52.degree. C.) was computed as follows: (1) The average elevated temperature of exposure, T.sub.av, is 125.degree. F. (52.degree. C.) (2) Elevated Temperature Soak Time, R.sub.e, is 8 hours. (3) Room Temperature Soak Time, R.sub.o, was computed as follows:

Detailed Description Text (285):
Therefore, it can be concluded that a temperature of 125.degree. F. (52.degree. C.) for eight hours is injurious to the sprouting capability of wheat and millet grain whereas a temperature of 104.degree. F. (40.degree. C.) for 8 hours is but slightly injurious to the sprouting capability of these grains.

Detailed Description Text (289):
The DG value for RUSTIC Sprouted Grain Products was computed as follows: (1) During their preparation RUSTIC Sprouted Grain Products were exposed to a temperature of 104.degree. F. (40.degree. C.) for periods of time in excess of 8 hours. (2) Therefore the average elevated temperature of exposure, T.sub.av, is 104.degree. F.. (40.degree. C.). (3) Elevated Temperature Soak Time, R.sub.e, is 8 hours. (4) Room Temperature Soak Time, R.sub.o,=8 hours-R.sub.e =0. (5) One pound each of wheat and millet were soaked in distilled water in a sealed thermally conductive container for 8 hours at a temperature of 104.degree. F. (6) After soaking for 8 hours, the wheat seeds weighed 1 lb. 8.6 oz. Thus W.sub.eo for the wheat=1.537 lbs. The millet seeds now weighed 1 lb. 5.6 oz. Thus W.sub.eo for the millet=1.35 lbs. (7) One pound each of wheat and millet were soaked in distilled water for 8 hours at a temperature of 30.degree. C. (8) After soaking for a total of 8 hours, the wheat seeds weighed 1 lb. 7.4 oz. Thus Wro for the wheat=1.462 lbs. The millet seeds now weighed 1 lb. 6.1 oz. Thus W.sub.ro for the millet=1.381 lbs. (9) The seeds of step 6 were sprouted for 48 hours. We for the wheat sprouts, We.sub.wheat =2 lbs. 4.5 oz.=2.281 lbs. We for the millet sprouts, We.sub.millet =1 lb. 15.4 oz.=1.963 lbs. .delta.We.sub.wheat =We.sub.wheat -Weo.sub.wheat =0.744 lbs. .delta.We.sub.millet =We.sub.millet -Weo.sub.millet =0.613. .delta.We.sub.comb, the combined weight gain of both wheat and millet sprouts,=.delta.We.sub.wheat +.delta.We.sub.millet =1.357 lbs. It should be noted that more than 95% of the wheat and millet seeds sprouted. (10) The seeds of step 8 were sprouted for 48 hours. Wr for the wheat sprouts, Wr.sub.wheat =2 lbs. 6.9 oz.=2.431 lbs. Wr for the millet sprouts, Wr.sub.millet =2 lbs. 2.5 oz.=2.156 lbs. .delta.Wr.sub.wheat =Wr.sub.wheat -Wro.sub.wheat =0.969 lbs. .delta.Wr.sub.millet =Wr.sub.millet - Wro.sub.millet =0.775 lbs. .delta.Wr.sub.comb, the combined weight gain of both wheat and millet sprouts,=.delta.Wr.sub.wheat +.delta.Wr.sub.millet =1.774. More than 95% of the wheat and millet seeds sprouted. (11) DG for this product was computed as follows:

Detailed Description Text (291):
The DG value of a product whose process included dehydration for 8 hours at 1250 F (52.degree. C.) was computed as follows: (1) The average elevated temperature of exposure, T.sub.av, is 125.degree. F. (52.degree. C.) (2) Elevated Temperature Soak Time, R.sub.e, is 8 hours. (3) Room Temperature Soak Time, R.sub.o,=8 hours-R.sub.e =0. (4) One pound each of wheat and millet were soaked in distilled water in a sealed thermally conductive container for 8 hours at a temperature of 125.degree. F. (5) After soaking for a total of 8 hours, the wheat seeds weighed 1 lb. 10.9 oz. Thus W.sub.eo for the wheat=1.681 lbs. The millet seeds now weighed 1 lb. 6.6 oz. Thus W.sub.eo for the millet=1.412 lbs. (6) The seeds of step 5 were sprouted for 48 hours. W.sub.e for the wheat sprouts, We.sub.wheat =1 lb. 13.3 oz.=1.831. We for the millet sprouts, We.sub.millet =1 lb. 7.4 oz.=1.462. .delta.We.sub.wheat =We.sub.wheat -Weo.sub.wheat =0.15 lbs. .delta.We.sub.millet =We.sub.millet - Weo.sub.millet =0.05 lbs. .delta.We.sub.comb, the combined weight gain of both wheat and millet sprouts,=.delta.We.sub.wheat +.delta.We.sub.millet =0.20 lbs. None of the wheat or millet seeds sprouted. The apparent gain in weight of the wheat and millet seeds over the 48 hour period is due to the wheat and millet seeds becoming more and more water-logged. (It should be noted that after 48 hours of attempting to sprout, both the wheat and millet seeds began to develop an offensive odor.) (7)

From step (10) of the Computation of DG for RUSTIC Sprouted Grain Products, W.sub.r for the wheat sprouts is 2.431 lbs. Likewise, W.sub.r for the millet sprouts is 2.156 lbs. (8) DG for this product was computed as follows:

Detailed Description Text (292):
Again, it can be concluded that a temperature of 125.degree. F. (52.degree. C.) for eight hours is highly injurious to the sprouting capability of wheat and millet grain whereas a temperature of 104.degree. F. (40.degree. C.) for 8 hours is only slightly injurious to the sprouting capability of those grains.

Detailed Description Text (305):
This method comprises the following steps: 1) Sprout the seeds. 2) Dehydrate the sprouts. 3) Mill the dehydrated sprouts to flour. 4) Mix the resultant sprout flour with water thus forming a mixture. 5) Mix, if necessary, a sufficient amount of an agglutinant with the above mixture so that the resultant product will be agglutinated. 6) Into the above mixture, stir pieces of pieces of absorbent vegetal matter selected from the group consisting of dehydrated fruits, dehydrated vegetables, and seeds selected from the group consisting of whole sesame seeds, hulled sesame seeds, whole poppy seeds, hulled sunflower seeds, steel cut hulled oats, and teff seeds, whereby a mixture of milled sprouts, pieces of absorbent vegetal matter, and any added agglutinant is formed. 7) Allow the pieces of absorbent vegetal matter in the mixture to absorb liquid from the mixture. 8) Spread this mixture onto a drying surface. 9) Dehydrate the mixture to a water activity below 60 percent with an air flow with the following characteristics: (i) the temperature of the air flow is less than 125.degree. F., so that most of the enzymatic activity of the product is preserved. (ii) the relative humidity of the air flow is less than 60 percent. (iii) the velocity of the air flow over the surface of the mixture is maintained high enough to dehydrate the product in less than 4 hours, whereby souring of the drying product is virtually eliminated; (iv) contains sound waves with the proper amplitude and frequency to so vibrate the surfaces of the drying batter so as to cause them to more quickly relinquish the moisture they contain.

Detailed Description Text (306):
Preferably the drying surface is a double-access drying surface, whereby the lower surface of the drying mixture (which is in contact with the upper surface of the double-access drying surface) and the upper surface of the drying mixture are both exposed to the drying effects of dehydration. Most preferably, the temperature, relative humidity, and velocity of the air flow will be set to such values as are required to dehydrate the drying mixture in the minimum amount of time possible, so as to, if possible, eliminate bacterial souring altogether.

Detailed Description Text (309):
Thus the reader will see that NP CLASS Crackers supply a long felt need for snacks and breads which are made from raw germinated seeds, grains, and nuts and yet are tasty and with excellent shelf life. When compared with the best such products currently for sale in this country, it will be seen that these new sprouted food products excel in many categories. Here are some categories for comparison: (1) Natural Enzyme Activity. The only close competitors are the sprouted sunflower seed products made by the method of the Douglass Patent. None of the other similar products currently found in health food stores have any significant enzyme activity, all of them having been damaged by high temperatures. This is a serious matter; we were meant to be at one with and a part of a natural organic environment. Heat damaged foods are alien to every living creature's diet; studies tend to indicate that our own digestive system does not handle heat damaged foods in the same way as raw foods, and this possibly leads to abnormally high weight gain, and, with the passing of years, various degenerative conditions which are totally foreign to creatures that eat a raw, wholesome, natural diet. (2) Vitamin E. There is no competition here; although sprouting brings about large increases in Vitamin E, other similar products (with the exception of the sprouted sunflower

seed products and some sprouted breakfast cereals) have been frozen which largely destroys Vitamin E. (3) Other Vitamins. Sprouting brings about such significant increases in most vitamins that similar unsprouted products pale by comparison. Furthermore all other similar products with the exception of the sprouted sunflower seed products have suffered vitamin loss due to excessive heat. (4) Proteins. The sprouting process dramatically improves the amino acid profile over the unsprouted seeds. (5) Fiber. NP CLASS Crackers have fiber as nature intended it: undamaged by heat, not separated from the foods nature intended it to be with (unlike the various brans currently available which are in such concentrated form that they occasionally cause more problems than they cure), and coupled with the enzymes which aid in its digestion. (6) Ease of Storage. Unlike the commercial sprout breads, NP CLASS Crackers need not be frozen, and therefore they should retain most of their vitamin E. In addition NP CLASS Crackers can be kept at room temperature without significant deterioration due having a water activity of less than 0.60. (7) Taste. Due to stopping bacterial souring at the peak of taste perfection in the two cheesy varieties of NP CLASS Crackers, my invention has a much better taste and far longer shelf life than the traditional homemade Essene sprouted breads. The methods for the two sweet varieties of NP CLASS Crackers limit bacterial souring to a .delta.pH.sub.LA of 0.1, resulting in a sweet pleasant tasting cracker. (8) Shelf-Stability. Due to their low water activity, NP CLASS Crackers resist mold, fermentation, and fungal growths, much better than any of their competitors (with the exception of sprouted sunflower seed products). (9) Health Promoting. By being prepared well below 160.degree. F., the temperature at which proteins are denatured and possibly become carcinogenic, and by containing all the fiber of the original sprouts, NP CLASS Crackers should not be a contributing factor to our country's current cancer epidemic. (As reported in Science Digest of May 1979, Drs. Chiu-Nan Lai, Betty J. Dabney and Charles R. Shaw of the University of Texas (Houston) suggested that some sprouts may have distinct cancer-preventive properties. When they applied extracts of wheat sprouts to certain known chemical mutagens, the activity of the chemicals diminished radically, by 99% in some instances. Mung bean and lentil sprouts performed similarly, while extracts of carrots and parsley did not do very well). (10) Economical Production. Due to the greater amount of batter which can be placed on each dehydrator tray, fewer trays and screens are required to process a given amount of batter. Further due to using minimal water in the cracker batter and spreading the batter on double access drying surfaces rather than upon solid drying surfaces, dehydration is greatly accelerated with attendant energy savings. The resultant NP CLASS Crackers can be made over four times thicker (over an inch thick without mold or fungal growths) than comparable dehydrated background art products and with a comparable or lower .delta.pH.sub.LA.

Detailed Description Text (311):
Thus the reader will see that the sprouted food products of my invention supply a long felt need for snacks and breakfast cereals which are made without either cooking or preservatives from raw germinated grains, and yet are tasty and have excellent shelf life. When compared with the best of such products currently for sale in this country, it will be seen that these new sprouted food products excel in many categories. My new food products excel in the following categories: (a) Neither preservatives nor nutrient-damaging heat is required to make these products. They are truly raw and additive free. (b) Due to the low temperature water activity reduction methods used to produce these products, bacterial souring and fungal growth is inhibited without resorting to either preservatives or nutrient damaging heat. Further, due to their low water activity, RUSTIC Sprouted Seed Products are shelf-stable. (c) By subjecting the compressed sprouts to be used in making either flavored compressed sprouts or compressed sprout cakes to reduced temperature and humidity after treating them with flavoring or agglutinant respectively, bacterial souring and fungal growth is inhibited while the water activity of the compressed sprouts is being reduced below the lowest water activity at which such microbial growth could still occur. Thus the methods taught in this specification solve a problem previously thought unsolvable: How to prepare raw sprouted food products without cooking or preservatives yet with excellent taste

and shelf-life. Dr. Edward Howell sought for years to develop such products yet failed. (d) Due to exposing only a small portion of the interior of the seed to the air, the nutrients of the compressed sprouted seed are afforded far more protection than is the case with any products of the background art. (e) The compressed sprouted seeds of the sprouted seed products described herein are not only of substantially uniform thickness and consistency throughout but also have and MD of less than 1. (The compressed sprouts of Example 1 had an MD of (2 lbs. 12.9 oz.)/(3 lbs. 8.2 oz.)=0.8.) Consequently, these products are very easily chewed. One need not be concerned about chipping a tooth while eating these products. (f) The compressed sprouted seed cakes of this patent application are simple to prepare. Since the discrete seeds of the compressed sprouted seed cakes are larger than the openings of the screen material used in the dehydrator trays, screens can be used instead of solid roll-up sheets. This facilitates drying of the product, as air can pass through the holes of the screens thus allowing both sides of the product to dry simultaneously. Further it is much easier to peel a dehydrator screen from the final product than it is to peel a solid roll-up sheet. This being the case, an oil is not required to prevent sticking, thus eliminating the only possible source of rancidity from my methods and greatly facilitating cleanup. (g) Natural enzyme activity. The only close competitors are the sprouted sunflower seed products made by the method of the Douglass Patent. None of the other similar products currently found in health food stores have any significant enzyme activity, all of-them having been damaged by high temperatures. (h) The ultrathin sprouted seed products produced via the long soak method followed by compression with the RUSTIC Press are very thin and thus rival anything found in the super market for consistency and mouth feel. (i) Sprouted Wheat, "puffed wheat" style, the result of soaking wheat for several days with periodic rinsings every 12 hours, followed by freezing results in a somewhat fragile structure, no doubt due a bursting of cell walls. As a result, when this soaked wheat is subsequently dehydrated, the result is a very tender and easily masticated product, closely resembling puffed wheat in consistency and crunchiness. So tender is the resultant product, that it hardly even needs to be compressed.

Detailed Description Text (321):
While the present invention has been described in terms of preferred embodiments and generally associated methods, the inventor contemplates that alterations and permutations of the preferred embodiments and method will become apparent to those skilled in the art upon a reading of the specification and a study of the drawings. For example, my invention can also be used to make pretzels and biscuits. And the seeds sprouted for later processing could include nuts, fruit pits, and such vegetable seeds as alfalfa and clover (as long as the agglutinated products were made with sufficient agglutinants to hold the products together). In addition, although my preferred methods for making the various embodiments of the instant invention utilize a dehydrator and a frost-free refrigerator to reduce water activity, other equipment and methods could also be used alone or in combination with one another, such as spray drying, utilization of reverse osmosis, vacuum chamber drying, dehumidification equipment, ultrafiltration equipment, foam-mat drying, tower drying at low temperatures in dehumidified air, and pressure-gun puffing of the partially dried product. In addition, although my preferred methods for making unflavored compressed sprout cakes use honey and sprouted wheat flour as agglutinants many other agglutinants could be used such as any sprouted or unsprouted gluten-containing grain and various kinds of fruit, vegetable, and grain and tree syrups.

Detailed Description Paragraph Equation (5):
R.sub.o =8 hours-R.sub.e =0. (5) 50 wheat grains were soaked in distilled water in a sealed container (to prevent evaporation) for 8 hours at a temperature of 104.degree. F. (40.degree. C.) (6) 50 wheat grains were soaked in distilled water for eight hours at 30.degree. C. (7) The grain of step 5 was sprouted for 48 hours. 47 of the 50 grains sprouted. Therefore, n.sub.e =47. (8) The grain of step 6 was sprouted for 48 hours. 48 of the 50 grains sprouted. Therefore, n.sub.r =48. (9) DV

was computed for this product as follows:

Detailed Description Paragraph Equation (7):
R.sub.o =8 hours-R.sub.e =0. (4) 50 wheat grains were soaked in distilled water in a sealed container (to prevent evaporation) for 8 hours at a temperature of 125.degree. F. (52.degree. C.) (5) The grain of step 4 was sprouted for 48 hours. None of the 50 grains sprouted. Therefore, n.sub.e =0. (6) From .sctn.5.9.2.5.1A step (8), n.sub.r is 48. (7) DV was computed for this product as follows:

Detailed Description Paragraph Equation (14):
R.sub.o =8 hours-R.sub.e =0. (5) 50 wheat grains were soaked in distilled water in a sealed container (to prevent evaporation) for 8 hours at a temperature of 104.degree. F. (40.degree. C.) (6) 50 wheat grains were soaked in distilled water for eight hours at 30.degree. C. (7) The grain of step 5 was sprouted for 48 hours. 47 of the 50 grains sprouted. Therefore, n.sub.e =47. (8) The grain of step 6 was sprouted for 48 hours. 48 of the 50 grains sprouted. Therefore, n.sub.r =48. (9) DV was computed for this product as follows:

Detailed Description Paragraph Equation (16):
R.sub.o =8 hours-R.sub.e =0. (4) 50 wheat grains were soaked in distilled water in a sealed container (to prevent evaporation) for 8 hours at a temperature of 125.degree. F. (52.degree. C.) (5) The grain of step 4 was sprouted for 48 hours. None of the 50 grains sprouted. Therefore, n.sub.e =0. (6) From Section A step (8) above, n.sub.r is 48. (7) DV was computed for this product as follows:

Detailed Description Paragraph Table (16):
Soak Water Temperature No. Out of 50 Sprouting DV (%) 70.degree. F. 48 0 104.degree. F. 47 0 to 6 125.degree. F. 0 96 to 100

Detailed Description Paragraph Table (17):
Combined Weight Gain of 1 pound of Wheat and 1 pound of Millet as Soak Water Temperature Result of Sprouting DGave (%) 70.degree. F. 1.774 pounds 0 104.degree. F. 1.357 pounds 22 125.degree. F. 0.200 pounds 89

Detailed Description Paragraph Table (27):
Soak Water Temperature No. Out of 50 Sprouting DV (%) 70.degree. F. 48 0 104.degree. F. 47 0 to 6 125.degree. F. 0 96 to 100

Detailed Description Paragraph Table (28):
Combined Weight Gain of 1 lb. of Wheat and 1 lb. of Millet as Soak Water Temperature Result of Sprouting DGave (%) 70.degree. F. 1.774 lbs. 0 104.degree. F. 1.357 lbs. 22 125.degree. F. 0.200 lbs. 89

Current US Original Classification (1):
426/61

CLAIMS:

17. The method of claim 16, wherein the step of reducing the water activity of the mixture comprises dehydrating the mixture to a water activity below 60 percent with an air flow with the following characteristics: (i) the temperature of the air flow is less than 125.degree. F., whereby the majority of the enzyme activity of the product is preserved; (ii) the relative humidity of the air flow is less than 60 percent; and (iii) the velocity of the air flow is maintained high enough to dehydrate the mixture in less than 4 hours, whereby souring of the drying mixture is virtually eliminated.